Comparative Study of Peak Expiratory Flow Rate in Cigarette Smokers and Non-Smokers of Lahore District

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Cigarette smoking is a menace and is contagious problem. Every effort is being made at governmental level to stop smoking. Even it has been declared as crime and punishable act. Ordinance about the penalty to cigarette smokers has been passed but in spite of all these efforts the cigarette smokers are still flourishing.

Objectives: The aim of this study was to provide the calculated and measured values about the damage incurred by smoking on the respiratory health. Only by this information the smokers can abstain from smoking.

Design: Cross-sectional comparative study.

Setting: General public from Lahore.

Materials and Methods: The study was done on a random sample of 1290 persons collected in six months duration from different areas of Lahore. After collecting the required data, peak expiratory flow rate of these subjects was recorded by mini-Wright's peak flow meter.

Results: The quantitative analysis of peak expiratory flow rate of smokers was less than non-smokers.

Conclusion: Smoking adversely affects the respiratory tree. So if this calculated damage is brought to the public notice it will help them to quit smoking.

Key words: Cigarette smoking, Peak expiratory flow rate, mini Wright's peak flow meter and non-smokers.

Introduction

The UN Health Agency reports that about 4.9 million people die each year across the globe due to cigarette smoking[1]. In United States, 440000 premature deaths are attributed to cigarette smoking[2]. The death toll is steadily increasing and unless current smoking trends are reversed, this figure is expected to rise to 10 million deaths per year by the 2020 or early 2030, with 70% of those deaths occurring in the developing countries[3]. Cigarette is the leading known risk factor for the development of chronic obstructive pulmonary disease and 50% of smokers develop clinically significant airflow obstruction[4]. The lung functions of cigarette smokers showed accelerated decline when compared with the non-smokers[5]. Tests of PEFR reflect changes in airways caliber[6]. Airflow obstruction in cigarette smokers is often diagnosed relatively late. Earlier detection of airflow obstruction and smoking cessation may result in significant health gain[7]. If a cigarette smoker stops smoking, peak expiratory flow rate improves with the passage of time[8].

Objectives

1. To measure and compare the peak expiratory flow rate of smokers and non-smokers.
2. To use peak expiratory flow rate as an early indicator and tool to identify the quantum of damage to respiratory tree.

Aim

To improve the health status of community by inculcating the knowledge about hazards caused by smoking.

Subjects and Methodology

PEFR of each subject was obtained with the help of a mini-Wright's peak flow meter (Clement Clarke). Each subject's PEFR was measured in litres per minute and then compared among all the groups according to height.

Study Plan

It was a cross-sectional study of PEFR in smokers and non-smokers of Lahore district. PEFR of the individuals was recorded as per planning and then it was statistically analysed. They were separated in smokers group and non-smokers group and their PEFR was compared. Their height measurements were taken by measuring height in centimeters with stadiometer by standard procedure without shoes[9].

There were eight subgroups (I-VIII) according to height in centimetres. They were named as Group I (134-141 cm), Group II (142-149 cm), Group III (150-157 cm), Group IV (158-165), Group V (166-173 cm), Group VI (174-181 cm), Group VII (182-189 cm) and Group VIII (190-197 cm). PEFR in each height group was compared with the corresponding height group in non-smokers and smokers.

Study Universe

As the smokers are found everywhere so this research work was done on general public in Lahore district in Punjab province. It included the smokers and non-smokers of Lahore district. The following places were visited and the persons of these areas were examined.

1 Postgraduate Medical Institute Lahore.
2. Services Institute of Medical Sciences Lahore.
3, Pappu pan shop proprietor Javed Iqbal Gulshan-e-Ravi Lahore.
4. Salsabeel Dispensary, Bhabra stop Lahore.
5. Awais clinic Band road Lahore.
6. Malik cold drink corner and pan shop Pakki Thatthi Lahore.
7. Lahore Polytechnic Institute, Chowk Yateem Khana, Lahore.
8. Kahna Nau rural health center, Ferozpur Road District Lahore.
9. Village Lalyani, Ferozpur Road District Lahore.
10. Burj Kalan, Free Dispensary Ferozpur road.
11. Chungh rural health center, Punjab Police Training School, Multan Road Lahore.
12. Manga Mundi, rural health center, Multan Road Lahore.
13. Burkey rural health center, near Wahga border Lahore.

Selection Criteria

Inclusion Criteria

The random sample of seven hundred and eighty one non-smokers and five hundred and nine cigarette smokers selected in the duration of six months fulfilled the following criteria:

1. Non smokers:

According to the definition, non smoker is a person who does not smoke tobacco[10]. The person under study:

i. were not dwelling in the home where their spouse or other family members were smokers of hookah, cigarette, cigar or biddy. In other words they were not passive smokers[11]. Passive smoking refers to exposure to tobacco combustion products from the smoking of others[12].
ii. was a resident of Lahore district as confirmed by history and his personal documents.

2. Cigarette smokers:

(i) They are the persons who are engaged in the inhalation and exhalation of the fumes of burning tobacco in cigarettes. By definition, cigarette smokers are the persons who inhale, exhale and burn or carry any lighted cigarette[13]. Every smoker must have smoked five cigarettes a day.

Exclusion Criteria

The following groups of persons were not included in the study:

i. The persons who were moribund or have a full-fledged picture of cor pulmonale on clinical examination.
ii. The known cases of bronchial asthma.
iii. Females were not included in this study.
iv. Persons who work in textile mills or other places where lungs are affected by dusts or fumes.

Data Collection

Each person fulfilling the inclusion criteria was included in the study. All persons were interviewed in detail and their clinical history was taken. After complete physical examination, the test was performed on the enrolled subjects in standing position holding the mini Wright's peak flow meter horizontally. A tight fitting disposable cardboard mouthpiece was inserted into the inlet nozzle. The person was asked to place the lips tightly around the mouthpiece. After proper rest, the subject was asked to take a deep breath and exhale as forcefully as possible in a single blow into the instrument[14]. The procedure was repeated thrice with an interval of half a minute between each attempt and the result of each recording was recorded in liters per minute. The best of the three readings was recorded.

Results

(A) ***PEFR In Non-Smokers:***

Table 1 shows that in Group I there were twenty-one persons and the mean ± SD of PEFR were 379 ± 63. In the Group II there were twenty-one persons and the mean ± SD of PEFR was 393 ± 68. In the Group III there were one hundred and ten persons and the mean ± SD of PEFR was 424 ± 86. In the Group IV there were one hundred and forty persons and the mean ± SD of PEFR was 449 ± 68. In the Group V there were two hundred and sixty eight persons and the mean ± SD of PEFR was 461 ± 73. In the Group VI there were one hundred and fifty four persons and the mean ± SD of PEFR was 474 ± 77. In the Group VII there were sixty-four persons and the mean ± SD of PEFR was 484 ± 70. In the Group VIII there were three persons and the mean ± SD of PEFR was 627 ± 21.

(B) ***PEFR In Smokers:***

Table 2 shows that in the Group I there were nine persons and the mean ± SD of PEFR was 285 ± 36. In the Group II there were thirteen persons and the value of PEFR was 293 ± 42. In the Group III there were one hundred and twelve persons and the mean ± SD of PEFR was 376 ± 82. In the Group IV there were one hundred and thirty persons and the mean ± SD of PEFR was 398 ± 91. In the Group V there were one hundred and forty six persons and the mean ±SD of PEFR was 403 ± 96. In the Group VI there were forty-six

persons and the mean ± SD of PEFR was 418 ± 72. In the Group VII there were forty-seven persons and the mean ± SD of PEFR was 427 ± 68. In the Group VIII there were four persons and the value of PEFR was 492 ± 21.

(C) *Comparison of the PEFR of the non-smokers and smokers.*

Table 3 shows comparison of PEFR of non-smokers and cigarette smokers. In Group I; the mean value of PEFR was 379 litres per minute in non-smokers while it was 285 litres per minute in smokers. The p-value was 0.01. In Group II; the mean value of PEFR was 393 litres per minute in non-smokers while it was 293 litres per minute in smokers. The p-value was 0.04. In Group III; the mean value of PEFR was 424 litres per minute in non-smokers while it was 376 litres per minute in smokers. The p-value was 0.01. In Group IV; the mean value of PEFR was 449 litres per minute in non-smokers while it was 398 litres per minute in smokers. The p-value was 0.0009. In Group V; the mean value of PEFR was 461 litres per minute in non-smokers while it was 403 litres per minute in smokers. The p-value was 0.0004**.** It was highly significant. In Group VI; the mean value of PEFR was 474 litres per minute in non-smokers while it was 418 litres per minute in smokers. The p-value was 0.006. In Group VII; the mean value of PEFR was 484 litres per minute in non-smokers while it was 427 litres per minute in smokers. The p-value was 0.01. In Group VIII; the mean value of PEFR was 627 litres per minute in non-smokers while it was 492 litres per minute in smokers. The p-value was 0.02. All these values were shown in figure 1.

Table 1: *Peak expiratory flow rate of non-smokers.*

Groups	Age (Years)	Height (Cm)	Non-Smokers (n)	PEFR (L/min) Mean ± SD
I	16 – 20	134 – 141	21	379 ± 63
II	21 – 25	142 – 149	21	393 ± 68
III	26 – 30	150 – 157	110	424 ± 86
IV	31 – 35	158 – 165	140	449 ± 68
V	36 – 40	166 – 173	268	461 ± 73
VI	41 – 45	174 – 181	154	474 ± 77
VII	46 – 50	182 – 189	64	484 ± 70
VIII	51 – 55	190 – 197	3	627 ± 21

Table 2: *Peak expiratory flow rate of smokers.*

Groups	Age (Years)	Height (Cm)	Smokers (n)	PEFR (L/min) Mean ± SD
I	16 – 20	134 – 141	9	285 ± 36
II	21 – 25	142 – 149	13	293 ± 42
III	26 – 30	150 – 157	112	376 ± 82
IV	31 – 35	158 – 165	130	398 ± 91
V	36 – 40	166 – 173	146	403 ± 96
VI	41 – 45	174 – 181	46	418 ± 72
VII	46 – 50	182 – 189	47	427 ± 68
VIII	51 – 55	190 – 197	4	492 ± 21

Table 3: *A comparison of PEFR of non-smokers and smokers.*

Groups	Age (Years)	Height (Cm)	Non-smokers PEFR (L/min) Mean ± SD	Smokers PEFR (L/min) Mean ± SD	p-Value
I	16 – 20	134 – 141	379 ± 63	285 ± 36	0.0119
II	21 – 25	142 – 149	393 ± 68	293 ± 42	0.0367
III	26 – 30	150 – 157	424 ± 86	376 ± 82	0.0113
IV	31 – 35	158 – 165	449 ± 68	398 ± 91	0.0009
V	36 – 40	166 – 173	461 ± 73	403 ± 96	0.0004
VI	41 – 45	174 – 181	474 ± 77	418 ± 72	0.0063
VII	46 – 50	182 – 189	484 ± 70	427 ± 68	0.0142
VIII	51 – 55	190 – 197	627 ± 21	492 ± 21	0.0222

Discussion

During the last few decades, lung function tests evolved from tools for physiologic study to clinical investigations in assessing respiratory status. They also became a part of routine health examination in respiratory, occupational, sports medicine and in public health screening. Tests have been designed to indicate the extent of the narrowing of the airways. A simple but important test is to measure how quickly air can be forced out from the lungs. This is called the peak expiratory flow rate (PEFR). Narrowing of the airways reduces the ability to move air in and out of the lungs. The narrower the tubes, the lower will be the PEFR[15].

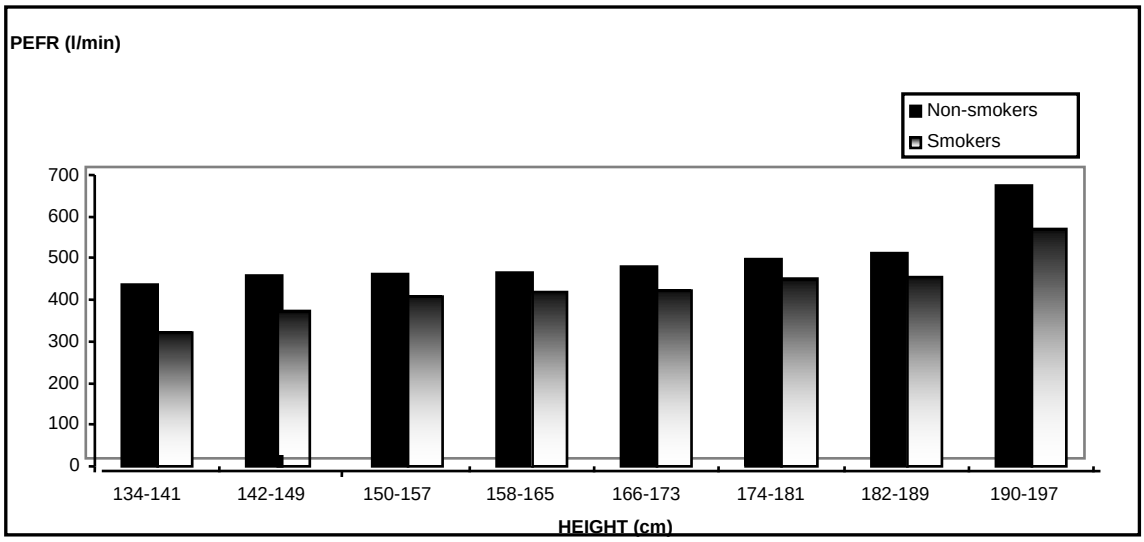

Figure 1: *A comparison of PEFR of non-smokers and smokers.*

In Canada, it was concluded in a study that decrease in airway caliber is the criteria for the therapeutic intervention of the obstructive airway disease[16].

Physicians usually refer to common international references for obtaining PEFR values, and each country to have its own reference values. The differences in the PEFR values of different countries can be explained on the basis of genetic factors, lifestyle, diet, height and environmental conditions. A study on Indian student girls was conducted to evaluate pulmonary functions with like height, $FEV_{1,}$ FVC, PEFR[17]. PEFR of Libyan school children was recorded with mini–Wright's peak flow meter. It differed from the British standard, which highlights the need for a local reference nomogram. The use of British or American PEFR standards when assessing Libyan children is inappropriate[18]. It is well established that height is the main factor affecting PEFR [19] and found to have effect on the ventilatory function of the lungs of the healthy subjects. In a scientific publication,[20] (Costes 1993) described this relationship that the PEFR increased with height. The relationship observed with height was more regular than with the other anthropometric measurements and this observation also coincided with the conclusion of the present research as shown in the results. Nadeem et al (1999) measured anthropometric data, forced expiratory volume in 1 sec (FEV1), forced vital capacity (FVC), peak expiratory flow (PEF) and forced expiratory flow at 50% of FVC (FEF50) of non smoker students of King Edward medical college Lahore (Pakistan) and found that height emerged as independent predictors of ventilatory function. The parameters correlated significantly with the height[21].

Considering the height of the persons the results showed that the mean PEFR in non-smoker population of the Lahore ranged between 379 litres per minute in the height Group I to 627 litres per minute in the height Group VIII. The PEFR of the persons increased as their height increased. The similar increment in the PEFR of the cigarette smokers of Lahore was observed as their height increased.

In an Australian study of the PEFR of the non-smokers according to height it was shown that the persons in the range of 134-141 centimetres had PEFR equal to 302 litres per minute while in this research the PEFR was 379 litres per minute. The PEFR in the general population of the Lahore district was 77 litres per minute better than the Australian population[22].

The PEFR of non-smokers was measured with mini-Wright's peak flow meter in south India and it was 285 litres per minute in the range of 134 to 141 centimetres. The PEFR in non-smokers of Lahore district according to the above-mentioned height was 379 litres per minute. Similarly in different comparable height groups the PEFR in Indian population were 311, 340, 364, 403 and 435 litres per minute[23] while the PEFR in the population of Lahore district was 393, 424, 449 and 474 litres per minute respectively.

So the PEFR of the Lahore district population was better than the south Indian population and it indicates that the difference was due to different ethnic groups. Similar ethnic differences were shown in the study of Kashmiri non-smokers[24]. The mean PEFR in cigarette smokers of the Lahore district ranged between 285litres per minute to 492 litres per minute It was found on the analysis of the results that the peak expiratory flow rate was less in the cigarette smokers than in the non-smokers. The difference between non-smokers and smokers was statistically significant. In the height Group V, peak expiratory flow rate of the non-smokers was 461 litres per minute while it was 403 litres per minute in cigarette smokers with a p-value of 0.0004 which was highly significant. So the smokers had 58 litres per minute lesser peak expiratory flow rate than non-smokers. Almost similar results were found in the differences of the PEFR of the smokers and non-smokers in all the groups.

In a study in Japan, it was shown that PEFR was lower in smokers than in non-smokers[25]. To compare lung functions between smokers and non-smokers using PEFR, a study was done by measuring the PEFR of three hundred and forty cigarette smokers with PEFR of equal number of non-smokers. The PEFR of smokers was found to be significantly lower than that of non-smokers suggesting that the lung function was significantly reduced in smokers[26]. On comparing this data with the mean values of the PEFR of the present research, it was found that the above mentioned results were lower than the results of the Lahore district study. It could be due to the fact that the Japanese have less baseline value.

Conclusion

The comparison of PEFR of non-smokers and smokers of Lahore was made on the basis of height. The PEFR of non-smokers was better than the smokers. The difference between non-smokers and smokers was statistically significant. Keeping in mind the futuristic vision, this research work could be further expanded by considering the confounders like exercise and walk in smokers and non-smokers.

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