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ORIGINAL ARTICLE

COMPARISON OF LUNG FUNCTIONS IN SMOKERS, PASSIVE SMOKERS AND SMOKING QUITTERS IN HARYANVI MALES OF VARIOUS AGE GROUPS

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ABSTRACT: INTRODUCTION: There is a clear relationship between the amount of cigarette smoked and mortality. Ironically there is also an increased incidence of cigarette smoking in women all over the world with an increased risk of spontaneous abortion in pregnant women. Although exposure is small as compared with that experienced by mainstream smokers, non-smoking passive smokers, who are in the same room may show pulmonary deposition of smoke particles as well as increased blood levels of nicotine and carboxyhaemoglobin, which became dangerous for infant and children. Smoking cessation is usually associate with improvement of lung functions, that can returns to normal over a period of time. **AIMS:** To compare the efficiency of lung function in active smokers, passive smokers and after cessation of smoking. **MATERIALS AND METHODS:** 200 subjects with various age groups ranging from less than 20 years upto 60 years, selected from the relative and attendants of patients attending the outpatient department and indoor wards. They were divided into study and control group. Their lung functions were tested by spirometry with the help of Medispiror. The results obtained were analyzed statistically. **STATISTICAL ANALYSIS:** the statistical analysis was done by using the formulas of two tail t test. **RESULT:** There is a highly significant ($p<0.001$) reduction in pulmonary function parameters in smokers as compared to non-smokers and quitters. Among the pulmonary function parameters the mean forced expiratory flow rates are significantly (respectively $p<0.05$, $p<0.01$) less in quitters as compared to non-smokers but FVC, FEV_1, PEFR. FEF_{25-75} are not reduced significantly ($p>0.05$). **CONCLUSION:** All the pulmonary functions get worse because of smoking and even passive smoking, which can come back to normal (as in non-smoker) after cessation of smoking, which is a true fact for both the genders.

KEYWORDS: Lung function & smoking, Smokers& smoking quiters, Lung function in passive smoking.

INTRODUCTION: Tobacco has replaced the tubercle bacilli as the great killer and the great disabler and soon it will be the developing countries where it will be adding to the already heavy burdens of ill health borne by the poor communities.

Though the cigarette smoking phenomenon is declining in the developed nations but the same is not true in the case of developing nations and ironically there is also an increased incidence of cigarette smoking in women all over the world. Cigarette smoking is a major cause of emphysema and chronic bronchitis collectively referred to as COPD. It is a major risk factor for Atherosclerosis underlying IHD. There is a clear relationship between the amount smoked and mortality.[1] Cigarette smoking increases the risk of carcinomas larynx oral cavity and esophagus by seven folds and contributes to cancer of kidney, urinary bladder and pancreas.[1] Smoking during pregnancy is associated with an increased risk of spontaneous abortion, prenatal mortality and reduced birth weight.[1]

DOI: 10.14260/jemds/2015/1314

Cigarette smoking over whelming is the most important contributor to the development of COPD, although other factors must play a role because many smokers do not develop disease.[2] Symptomatic air flow obstruction usually does not become apparent unit after the age of 50 years or until 20 or 30 years of smoking.[2]

Smoking quite often results in obstructive type of lung disease. There is statistically significant relationship between the degree of impairment of airflow and quantity of cigarette smoked.[2]

The numerous cross sectional studies documenting the adverse effects of smoking on lung function have been well summarized in 1984 report of the Surgeon General, that demonstrate an excessive rate of decline in FEV_1 among smokers, which have been confirmed by several longitudinal studies.[3]

Although exposure is small as compared with that experienced by mainstream smokers, passive smokers who are in the same room may show pulmonary deposition of smoke particles as well as increased blood levels of nicotine and carboxyhaemoglobin.

Epidemiological studies have shown an increased incidence of respiratory illness and functional impairment in infants and children living in same house as parents and siblings who smoke.[2] In such individuals the effect being greater with maternal than paternal smoking, because a decrease in expiratory flow at an early age will contribute to a more rapid substantial decline in lung function.[4]

Smoking cessation is usually associated with some improvement in lung functions and the symptoms of coughing and sputum expectoration often disappears completely, although the improvement may be small. The rate of annual decline in lung function diminishes or returns to normal over a period of time following cessation of smoking.

MATERIAL AND METHODS: The present study was carried out in the Department of Physiology, Gold Field Institute of Medical Sciences and Research, Faridabad, after consent from the Institutional Ethical Committee.

The subjects for the study and control were selected from the relative and attendants of the patients attending the outpatient department and indoor wards, who are belongs to same socio-economic status.

A questionnaire was distributed to all the subjects, which includes the age, type of smoking, duration of smoking, quantity of smoking, pattern of inhalation and exhalation. For passive smokers, smoke exposure related variables such as duration of exposure, proximity to the source, room size, ventilation and number of cigarette smoked as per the source of tobacco smoke. Detailed history with special emphasis on respiratory symptoms like cough, hemoptysis etc. was also recorded.

Exclusion Criteria:

Following subjects were excluded from the study:

1. Whose status of smoking was not stable.
2. Those suffering from respiratory or cardio-vascular diseases like asthma, pulmonary tuberculosis, pleurisy, chronic obstructive lung disease.
3. Those having history of cough with sputum, haemoptsis.
4. Those with history of hospitalization with chronic ailment.

DOI: 10.14260/jemds/2015/1314

Criteria for Labelling the Cases:

Non Smoker (Control): one who has never smoked a cigarette.

Active Smoker: one who has been smoking at least one cigarette per day for last five years.

Passive/Indirect Smoker: One who lives in the same enclosed environment (household) were at least one smoker lives for at least five years.

Caesation of Smoking (Quitter): It is applicable when a smoker has quit smoking for at least six months back.

Plan of Investigation: A detailed clinical history and thorough physical examination of each subject was done. X-ray chest were done whenever required.

METHODS:

ANTHROPOMETRIC MEASUREMENTS:

Measurement of Height: Height was measured in centimeters without shoes in standing posture, heel together, meals calf buttocks and back touching the stundiometer (low cerebral margin was at the level with the external auditory meatus).

Measurement of Weight: The subjects were weighted by weight machine in Kilograms with shoes off and in minimal clothing.

Measurement of Temperature: It was measured with the help of mercury thermometer in degree Celsius.

Spirometery: Spirometery was done with medispiror in the morning hours (10 AM to 12 PM).

Meidspiror: Medispiror is available as a free standing unit and is designed to be used with the electro mechanical Pumoatach supplied with the instrument. It has got built in 40 column perimeter and is designed to work at a power supply of 230 volts and 50 Hz AC current. It has got a range of volume 0-8 litres and tunt for flow is 0-16 litres/sec.

Medisprior may be used to calculate the following test results:

- FVC Force Expiratory Volume in ½ sec.
- FEV_1 Force Expiratory Volume in 1 sec.
- FEV_3 Force Expiratory Volume in 3 sec.
- PEFR Peak Expiratory Volume in flow rate.
- FEF_{25-75} Mean forced expiratory flow during the middle half of the FVC.
- FEF_{2-20} Mean forced expiratory flow rate between 2 to 1.2 litres of volume change.
- FEF_{25} Forced expiratory flow after 25% of the FVC has been expired.
- FEF_{50} Forced expiratory flow after 50% of the FVC has been expired.
- FEF_{75} Forced expiratory flow after 75% of the FVC has been expired.
- $FEV._5$/FVC Forced expiratory volume (Tuned) to forced vital capacity ratio expressed as a percentage.
- MVV Maximum voluntary ventilation.

The medispiror is connected to power supply through CVT. When the medispiror is turned on or restarted by pressing R the display read 0 and the test led is on. F is entered for FVC manoeuvre. Then the height in cms in three digits, age in years in two digits, weight in kilograms is entered. M for

DOI: 10.14260/jemds/2015/1314

male and F for female are pressed. Finally, temperature in degree Celsius was entered and display read 000 that time.

Subjects were asked to inhale maximally and placing the mouth piece firmly and clipping the nose were asked to perform maximal expiration.

As soon as subject stated expiration E button was pressed. Three reading were taken. Best reading was printed by pressing P and then pressing E four times (Each time after entering subject no., day, month and year).

All the readings were taken in the sitting/standing posture in the morning hours (between 10 am to 12 am).

Data was coded on master charts and analysed.

RESULTS: The present study entitled "Comparison of Lung Functions in Smokers, Passive Smokers And Smoking Quitters In Haryanvi Males of Various Age Groups" was conducted in the Department of Physiology, Gold Field Institute of Medical Sciences and Research, Faridabad.

Only males are included in this study, not the females, because of very low prevalence of smoking in Indian females as well as psychosocial impact on female smokers leading to concealment of history of smoking.

Table 1 shows smokers, non-smokers, passive smokers and quitters among various age groups ranging from less than 20 years up to 60 years. Maximum number of smokers 100 were in age group 21-30 years followed by 80 in age group 31-40 years. The maximum number of non-smokers 58 was in age group 21-30 years followed by 42 in age group 41-50 years.

Table 2 shows the distribution of smokers, passive smokers and quitters according to their height. Maximum number of subject 209(30%) were in height range of 145-1455cms followed by 179(27%) in height range of 156-160cms. Only 4 subjects were taller than six feet.

Table 3 shows distribution of smokers according to duration of smoking. Maximum number of subjects 96(28.57%) were smokers for 5-10 years duration followed by 84 (25.00%) who were smokers for >25 years.

Table 4 shows distribution of smokers according to smoking index. Maximum number of smoker 160(47.50%) were from 0-100 smoking index range followed by 64(19%) from 101-200 smoking index category. Minimum number of smokers 8(2.5%) were in >700 smoking index category.

Table 5 shows pulmonary function in various age groups in non-smokers. There is a gradual decline in all pulmonary function parameters with increasing age. Maximum lung functions are seen in age group 21-30 years. Maximum peak expiratory flow rate was seen in age group younger than 20 years.

Table 6 shows decline in lung function with increasing age in non-smokers. Maximum value of lung function parameters in seen in age group 21-30 years.

Table 07 shows pulmonary functions according to height in non-smokers. All the parameters of lung functions increases with increase in height.

Table 08 shows pulmonary function according to smoking index in smokers. There is reduction in the parameters of lung function with increasing smoking index.

Table 09 shows gradual decline in all the parameters of pulmonary function with increase in duration of smoking. There is inverse relation of pulmonary function with duration of smoking.

DOI: 10.14260/jemds/2015/1314

Table 10 shows a declining trend in lung function with increasing age. The decline in FEV_1 and PEFR is much more as compared to non-smokers.

Table 11 shows that there is decline in lung function with advancing age in passive smokers.

Table 12 shows highly significant ($p<0.001$) reduction in pulmonary function parameters in smokers as compared to non-smokers.

Table 13 shows that among the pulmonary function parameters FEF_{2-12}, FEF_{75} and FEF_{25}, FEF_{50} are significantly (Respectively $p<0.05$, $p<0.01$) less in quitters as compared to non-smokers but FVC, FEV_1, PEFR. FEF_{25-75} are not reduced significantly ($p>0.05$).

Table 14 shows comparison of different parameters of pulmonary function in non-smokers and significantly ($p<0.001$) less in passive smokers as compared to non-smokers.

Table 15 shows that the lung functions are significantly ($p<0.05$, 0.01 and <0.001) less in smokers as compared to quitters.

Table 16 shows that statistically there is no significant ($p>0.05$) difference in the pulmonary function parameters in between smokers and passive smokers, except for FEF_{25} and FEF_{50} ($p<0.01$).

Table 17 depicts comparison of pulmonary function in smokers, non-smokers, and passive smokers and quitters. The value of pulmonary function parameters is maximum in non-smokers and lowest in smokers out of the four groups. The pulmonary function parameters of quitters are in between non-smokers and smokers (Much nearer to the values in non-smokers). The pulmonary function parameter values of passive smokers are in between that of smokers and non-smokers and much nearer to the values in smokers.

Table 18 shows comparison of pulmonary function in all groups i.e. smokers, quitters, non-smokers and passive smokers in three age groups (Adult, middle aged and late middle aged group). Smokes have less lung function as compared to non-smokers in all the three age groups while quitters have almost the same values of lung function parameters as those of non-smokers in all the three age groups especially in the middle age (35-45 years) and late middle age (>45 years). The values of pulmonary function parameters in passive smokers in age group <35 years are in between that of smokers and non-smokers. In the age groups, 35-45 years and >45 years, the values of pulmonary function parameters in passive smokers are nearly the same as those of smokers.

DISCUSSION: In the present study, it was observed that the younger persons were more prone to indulge in the habit of smoking. The highest rate of smoking was observed in the age group of 21-30 years followed by 31-40 years age group. The most perceived cause for this trend appears to be age related feeling of excitement, fun, pressure, peer group, to lessen tension and anxiety, to relax during boring periods and social routine.

Quitters were maximum in number in the late middle (>45 years of age) age group.

Values of all parameters of pulmonary function tests were found highest in age group 21-30 years. All the parameters showed a declining trend with advancing age.

Scientists also observed that FEV_1, PEFR, FVC all declined with advancing age which is in agreement with the present Study.[5,6,7]

Advancing age is known to produce degenerative changes in the musculoskeletal system of the thoraco–abdominal compartment. This imposes a limitation on the maximal effort for inspiration as well as expiration in reduced value of ventilatory capacity. Loss of elastic tissue with advancing age may also be a factor, other possible explanation may be an associated change in the lung volume at which airway closure occurs and increased pulmonary flow resistance in the elderly.[8]

DOI: 10.14260/jemds/2015/1314

In the present study we have observed that the age showed a negative correlation while height showed a positive correlation with pulmonary function tests.

We have found that there is marked decline in pulmonary function of heavy smokers in the present study and the changes in parameters of pulmonary function tests are greater in heavy smokers a compared to light smokers ($p<0.01$). Scientists observed that the heaviest smokers have the poorest pulmonary function.[9] Thus, our findings are in agreement with the findings of previous studies.[9]

In the present study smokers have lower level of FEV_1 (2.34±0.41) than non-smokers (2.59±0.41) at all ages. Smokers with 20 or more cigarettes smoking/day had more impaired lung function that any other group. Some Scientists had also observed that cigarette smokers had lower level of FEV_1 than non-smokers at all ages and heavy smokers had greater impairment of lung functions.[10] Thus the findings of present study are in agreement with the findings of previous in this context.[10]

In some of the previous studies it was observed that in men there were excessive rates of decline in FEV_1 in smokers, at least in those smoking more than 10 cigarettes/day.[11] Thus the observations of present study are supported by findings of previous studies.[11]

In the present study, there is a significant reduction of flow rates in heavy smokers than light smokers or non-smokers ($p<0.001$).

Scientists has reported the results of an investigation of the effect of smoking habits on lungs and lung function in working population aged to 65 years.[12] He found that the flow rates were significantly lower in heavy smokers compared with light smokers and non-smokers. Thus our findings are in agreement with the findings of previous studies.[12]

We have found in the present study that there is marked reduction of pulmonary function with increasing duration of smoking. There is a marked decline of FEV_1 at 16-20 years duration of smoking as compared to 5-10 years of smoking duration period.

Scientists observed that long term tobacco smoking has resulted in decline in parameters of pulmonary functions and reported significantly abnormal values of FEV_1, FVC, PEFR and FEF_{50} among chronic smokers.[13] Thus, our findings are in agreement with the findings of previous study of previous studies.[13]

In the present study there is a significant worsening of pulmonary function with increasing smoking index ($p<0.001$). The heaviest smokers have marked decline in ventilatory function with rising smoking index.

Scientists observed similar pattern of reduction of pulmonary function which increased with smoking index.[13] So, the present study is in agreement with such previous studies.

Scientists reported a trend of fall in the FEV_1 % with increasing smoking index, and also observed and accelerated rate of loss of FEV_1 in male smokers around 55 ml/year.[13,14] Some scientists also reported a mean decline in FEV_1 of 60 ml/year over a period of twelve years.[15.16] Thus the findings of present study were in alignment with all these previous studies.

In the present study there is a downward trend in FEV_1, PEFR, FEF_{25-75}, FEF_{25}, FEF_{50} FEF_{75} values with increased smoking. The findings of our study are consistent with previous studies, where the scientists also observed similar trend.[12,17,18]

We have found that there is a significant difference between the decline of peak expiratory flow rate in smokers and non-smokers ($p<0.001$). The decline of peak expiratory flow rate increases with advancement of age and also with increasing intensity of smoking.

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A group of scientists found a significant difference between the regression of peak expiratory flow rates with age in male smokers who denied any symptoms and then in men who never smoked.[19] Thus our findings tally with the findings of those scientists.[19]

In the present study, we observed lower values of peak expiratory flow rate and forced expiratory flow rates ($FEF_{25,}$ $FEF_{50,}$ FEF_{2-12}) among smoking as compared to non-smokers ($p<0.001$).

Scientists observed lower values of FEF_{2-12}, FEF_{25}, FEF_{50} rate in smokers than non-smokers. The present study is very similar to that study.[20]

In this study, there was a significant decline in all the pulmonary function parameters in passive smoking on pulmonary function was less compared with active smoking.

There was reduction of 8.2% in FEV_1 and PEFR (904%) and FEF_{25-75} (910%) in passive smokers in our study.

Previous studies reported small airway dysfunction with a 14% reduction in FEF_{25-75} in non-smokers exposed to environmental tobacco smoke, however, a fully of 5% in FEV_1 and 3% in FVC were not significant in their study.[21]

Our study corresponds with this study about the small airway dysfunction but strikes a note of statistically significant decline in FEV_1 and FVC, the most probable reason may be that in our study the passive smokers and non-smokers were almost age matched (Mean age for non-smokers was 34.87±10.82 years and mean age for passive smokers was 36.08±11.29 years).

Masjedi M.R. et al. (1989) in a study in Tehran Showed a significant reduction in %predicted FEV_1 (5.7%), FVC (4.6%) and FEF_{25-75} (9.9%) in male passive smokers while the reductions were even greater among age matched male passive smokers (7.3% in $FEV_{1,}$ 5% in FVC and 15.4% in FEF_{25-75}). The PEFR was significantly reduced (6.4%) in age matched group.

In our study, there was a significant reduction in% predicted FEV_1 (9%), FVC (7%) and FEF_{25-75}(9%) in male passive smokers. Thus our study is in agreement with the finding observed by previous scientists.[22]

Men exposed to passive smoker at home showed a 6% fall in FEF_{25-75} and a non-significant 4% fall in $FEV_{1.}$

In our study, we have found greater % of fall of FVC and FEV_1 than what is reported by earlier studies but less of decrease in FEF_{25-75}.[21,23]

In our opinion, the larger decrement observed in our study could be because there was a greater exposure to environmental tobacco smoke intensity and duration among our subjects and the other contributing factors may be poor ventilation in house and workplace among population of lower socio-economic status. Agra is one of the most thickly polluted industrial cities in the world. Thus environmental smoke may be another contributing factor.

As most subjects of our study were unable to quantify the amount of exposure to passive smoke. We could not relate pulmonary function to the number of years or hours/day exposure to cigarette smoke.

This study showed quitters/former smoker group (who have ceased to smoke) and smokers had had less degree of function as compared to non-smokers. Pulmonary functions of quitters (FVC 3.02, FEV_1 2.48. PEFR 7.82) were in between that of nonsmokers (FVC 3.12, FEV_1 2.59, PEFR 8.03) and smokers (FVC 2.84, FEV_1 2.34, PEFR 7.46).

Pulmonary functions of quitters were not significantly lowered as compared to non-smokers ($p>0.05$) except forced expiratory flow rates ($p<0.05$). The pulmonary function of quitters were significantly higher as compared to smokers ($p<0.05$).

In all three groups the adults (<35 years of age), middle aged (35-45 years of age) and late middle age (>45years of age) FEV_1/FVC ratio was better in quitters as compared with smokers while it was almost identical in non-smokers and quitters.

An earlier longitudinal study showed that the decrease in FVC and FEV_1 was significantly less in quitters than the smokers.[24] The study suggested a definite beneficial effect of smoking cessation. Our study is in agreement with the findings of that study.[24]

In earlier study scientists found that the rate of decline in FEV_1 values similar in non-smokers and quitters and their study suggested prompt beneficial effect of cessation even in late middle age.[11] This study is in agreement with that study.

CONCLUSIONS: In this study it was concluded that all the pulmonary functions get worse because of smoking and even passive smoking, which can come back to normal (As in non-smoker) after cessation of smoking.

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Age Group (Yrs)	Smokers	Non-Smokers	Quitters	Passive Smokers	Total
<20	20 (5.98)	10 (7.57)	0	8 (12.90)	38
21-30	100 (29.9)	36 (27.27)	8 (21.05)	18 (29.03)	162
31-40	80 (23.95)	20 (15.15)	7 (18.42)	12 (19.35)	119
41-50	68 (20.35)	34 (25.75)	12 (31.57)	10 (16.12)	126
51-60	68 (20.35)	32 (24.24)	11(28.94)	14 (22.58)	125
Total	**336**	**132**	**38**	**62**	**570**

Table 1: Smokers, non-smokers, passive smokers and quitters among various age groups

Height (Cms)	Smokers	Non-Smokers	Quitters	Passive Smokers	Total
145-155	92 (27.38)	22 (16.67)	8	9 (23.68)	209 (30.82)
156-160	92 (27.38)	84 (25.75)	24 (38.11	9 (23.68)	179 (26.40
161-165	64 (19.04)	30 (22.72)	18 (29.03)	8 (21.05)	130 (19.17)
166-170	28 (8.33)	26 (19.69)	6 (9.68)	6 (15.79)	66 (9.73)
171-175	40 (11.90)	12 (9.09)	4 (6.45)	5 (13.15)	63 (9.29)

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176-180	16 (4.76)	8 (6.06)	2 (3.22)	1 (2.63)	27 (3.98)
>180	4 (1.19)	0	0	0	4 (0.58)
Total	**336 (100)**	**132 (100)**	**62 (100)**	**38 (100)**	**678 (100)**

Table 2: Distribution of smokers, passive smokers and quitters according to their height

Duration	No.	Percentage
5-10	96	28-57
11-15	60	17-85
16-20	48	14.28
21-25	48	14.28
>25	84	25.00
Total	**336**	**100.00**

Table 3: Distribution of Smokers According to Duration of Smoking

Smoking Index	No.	Percentage
0-100	160	47.50
101-200	64	19.00
201-300	29	8.50
301-400	24	7.00
401-500	20	6.00
501-600	13	4.00
601-700	18	5.50
>700	8	2.50

Table 4: Distribution of Smokers According to Smoking Index

Age Group	FVC	FEV_1	FEV_3	PEFR	FEF_{25-75}	FEF_{2-12}	FEF_{25}	FEF_{50}	FEF_{75}
≤20	2.89	2.50	2.85	8.00	4.28	7.07	7.20	5.62	3.16
n=14	±0.45	±0.43	±0.46	±1.02	±0.46	±0.95	±0.87	±0.59	±0.26
21-30	3.10	2.58	2.99	7.50	4.11	6.80	7.12	5.44	3.12
n=58	±0.78	±0.57	±0.63	±1.90	±0.56	±1.22	±1.09	±0.72	±0.53
31-40	2.69	2.21	2.65	7.23	3.54	5.77	6.68	4.95	2.57
n=40	±0.62	±0.54	±0.63	±1.44	±0.53	±1.18	±1.14	±0.71	±0.28
41-50	2.82	2.37	2.75	7.56	3.42	5.63	7.05	5.01	2.22
n=43	±0.44	±0.43	±0.46	±1.00	±0.52	±0.81	±0.79	±0.45	±0.20
51-60	2.66	2.10	2.59	7.02	2.98	5.08	6.86	4.91	1.94
n=38	±0.50	±0.38	±0.50	±1.29	±0.32	±0.80	±0.84	±0.84	±0.19

Table 5: Pulmonary Function Status According to Age Group in Non-Smokers (Mean±SD)

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Age Group	FVC	FEV_1	FEV_3	PEFR	FEF_{25-75}	FEF_{2-12}	FEF_{25}	FEF_{50}	FEF_{75}
≤20	3.08	2.70	3.05	8.58	4.53	7.64	7.72	5.99	3.24
n=10	±0.37	±0.30	±0.37	±0.49	±0.24	±0.31	±0.31	±0.08	±0.26
21-30	3.52	2.95	3.37	8.23	4.51	7.63	7.84	5.94	3.37
n=36	±0.61	±0.27	±0.32	±2.01	±0.81	±0.44	±0.51	±0.19	±0.52
31-40	3.21	2.67	3.19	8.52	4.00	6.80	7.71	5.59	2.80
n=20	±0.33	±0.33	±0.39	±0.57	±0.17	±0.43	±0.29	±0.21	±0.13
41-50	2.93	2.45	2.87	7.91	3.54	5.90	7.36	5.18	2.26
n=34	±0.37	±0.37	±0.37	±0.57	±0.45	±0.55	±0.28	±0.21	±0.20
51-60	2.83	2.24	2.77	7.43	3.11	5.38	7.22	5.16	2.00
n=32	±0.39	±0.27	±0.38	±1.00	±0.18	±0.55	±0.31	±0.74	±0.15

Table 6: Decline in Pulmonary Function Status According to Age Group in Non-Smokers (Mean±SD)

Height (Cms)	FVC	FEV_1	FEV_3	PEFR	FEF_{25-75}	FEF_{2-12}	FEF_{25}	FEF_{50}	FEF_{75}
145-150	2.11 ±0.23	1.72 ±0.24	2.06 ±0.25	5.99 ±0.88	3.17 ±0.69	4.81 ±0.80	5.81 ±0.78	4.34 ±0.49	2.29 ±0.40
151-155	2.41 ±0.27	1.97 ±0.26	2.34 ±0.31	6.64 ±0.97	3.29 ±0.48	5.29 ±0.85	6.29 ±0.89	4.69 ±0.53	2.41 ±0.36
156-160	2.88 ±0.36	2.37 ±0.37	2.83 ±0.37	7.57 ±1.28	3.68 ±0.58	6.08 ±1.07	7.24 ±0.67	5.23 ±0.50	2.55 ±0.51
161-170	3.13 ±0.26	2.66 ±0.29	3.09 ±0.30	8.31 ±0.75	3.89 ±0.62	6.44 ±1.16	7.52 ±0.10	5.65 ±0.75	2.70 ±0.57
171-175	3.57 ±0.74	2.87 ±0.37	3.33 ±0.34	7.52 ±2.38	4.07 ±0.63	7.17 ±1.04	7.62 ±0.63	5.70 ±0.44	2.83 ±0.59
176-180	3.59 ±0.25	3.01 ±0.28	3.53 ±0.27	9.02 ±0.44	4.04 ±0.53	7.10 ±0.78	7.42 ±0.32	5.72 ±0.37	3.24 ±1.15
>180	3.82 ±0.18	3.00 ±0.22	3.78 ±0.17	9.27 ±0.37	3.86 ±0.39	6.93 ±0.61	8.07 ±0.21	5.69 ±0.28	2.62 ±0.35

Table 7: Pulmonary Function Status in According to Height in Non- Smokers(Mean±SD)

Smoking Index	FVC	FEV1	PEFR
0-100	3.14±0.62	2.52±0.51	7.80±0.63
101-200	2.95±0.39	2.41±0.47	7.54±0.84
201-300	2.73±0.96	2.27±0.53	7.23±0.82
301-400	2.51±0.74	2.12±0.67	7.06±1.02
401-500	2.45±0.79	1.93±0.63	6.89±0.82
501-600	2.36±0.53	1.84±0.22	6.72±0.86
>600	2.11±0.54	1.75±0.34	6.50±0.46

Table 8: Pulmonary Function Status in Smokers According to Smoking Index (Mean±SD)

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Duration (Years)	FVC	FEV_1	FEV_3	PEFR	FEF_{25-75}	FEF_{2-12}	FEF_{25}	FEF_{50}	FEF_{75}
5-10	2.94 ±0.43	2.57 ±0.41	2.92 ±0.43	7.97 ±0.87	3.93 ±0.49	6.36 ±1.00	6.37 ±1.09	5.08 ±0.71	2.84 ±0.34
11-15	2.87 ±0.40	2.44 ±0.37	2.85 ±0.41	7.69 ±0.97	3.66 ±0.33	6.15 ±0.61	6.64 ±0.70	4.81 ±0.58	2.56 ±0.27
16-20	2.83 ±0.43	2.32 ±0.43	2.80 ±0.45	7.38 ±0.87	3.33 ±0.42	5.57 ±0.80	6.62 ±0.76	4.73 ±0.55	2.29 ±0.30
21-25	2.94 ±0.47	2.35 ±0.39	2.91 ±0.47	7.25 ±0.90	3.00 ±0.43	5.28 ±0.75	6.37 ±0.80	4.49 ±0.50	2.07 ±0.30
>25	2.66 ±0.41	2.09 ±0.32	2.62 ±0.42	6.59 ±0.81	2.81 ±0.43	4.70 ±0.75	6.05 ±0.88	4.34 ±0.60	1.81 ±0.36

Table 9: Pulmonary Function Status According to Duration of Smoking in Smokers (Mean±SD)

Age Group	FVC	FEV_1	FEV_3	PEFR	FEF_{25-75}	FEF_{2-12}	FEF_{25}	FEF_{50}	FEF_{75}
≤20	2.85	2.43	2.85	7.85	4.17	6.77	6.89	5.55	2.98
n=20	±0.38	±0.41	±0.37	±0.87	±0.44	±0.93	±0.89	±0.65	±0.13
21-30	2.96	2.52	2.94	7.88	3.83	6.26	6.50	4.92	2.75
n=100	±0.44	±0.41	±0.44	±0.95	±0.45	±0.87	±1.01	±0.60	±0.32
31-40	2.96	2.46	2.93	7.69	3.49	5.86	6.57	4.75	2.39
n=80	±0.40	±0.34	±0.40	±0.75	±0.37	±0.66	±0.74	±0.59	±0.28
41-50	2.79	2.26	2.76	7.30	3.09	5.38	6.61	4.73	2.16
n=68	±0.40	±0.34	±0.40	±0.87	±0.40	±0.74	±0.82	±0.59	±0.32
51-60	2.59	2.07	2.55	6.62	2.67	4.10	5.86	4.11	1.65
n=68	±0.43	±0.31	±0.43	±0.77	±0.40	±0.63	±0.83	±0.43	±0.17

Table 10: Pulmonary Function Status According to Age Group in Smokers (Mean±SD)

Age Group	FVC	FEV_1	FEV_3	PEFR	FEF_{25-75}	FEF_{2-12}	FEF_{25}	FEF_{50}	FEF_{75}
≤20	2.65	2.25	2.61	7.27	3.93	6.33	6.48	5.32	2.93
n=10	±0.35	±0.36	±0.35	±0.48	±0.48	±0.94	±0.94	±0.82	±0.34
21-30	2.81	2.37	2.75	7.43	3.79	5.87	6.55	4.95	2.77
n=34	±0.57	±0.54	±0.55	±0.38	±0.57	±1.32	±1.06	±0.68	±0.34
31-40	2.61	2.12	2.57	6.87	3.26	5.40	6.27	4.58	2.29
n=30	±0.50	±0.44	±0.50	±1.02	±0.43	±0.89	±0.81	±0.59	±0.25
41-50	2.38	1.90	2.34	5.95	3.00	4.87	6.15	4.38	2.05
n=16	±0.33	±0.21	±0.34	±0.72	±0.49	±0.97	±1.15	±0.70	±0.26
51-60	2.34	1.76	2.29	6.17	2.67	4.26	5.64	4.07	1.74
n=22	±0.44	±0.36	±0.43	±0.77	±0.60	±0.79	±0.93	±0.49	±0.34

Table 11: Pulmonary Function Status According to Age Group in Passive Smokers (Mean±SD)

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Pulmonary functions	Smokers N=336	Non-smokers N=132	t	P	Inference
FVC	2.84±0.44	3.12±0.53	5.38	<.001	Highly significant
FEV_1	2.34±0.41	2.59±0.41	5.94	<.001	Highly significant
FEV_3	2.81±0.45	3.05±0.43	5.36	<.001	Highly significant
PEFR	7.46±0.97	8.03±1.29	4.59	<.001	Highly significant
FEF_{25-75}	3.39±0.62	3.84±0.63	6.98	<.001	Highly significant
FEF_{2-12}	5.64±0.92	6.51±1.05	8.07	<.001	Highly significant
FEF_{25}	6.43±0.67	7.54±0.44	17.58	<.001	Highly significant
FEF_{50}	4.71±0.67	5.50±0.54	13.27	<.001	Highly significant
FEF_{75}	2.34±0.52	2.66±0.64	5.38	<.001	Highly significant

Table 12: Comparison of different parameters of Pulmonary Function in Smokers and Non-smokers (Mean±SD)

Pulmonary functions	Smokers N=38	Non-smokers N=132	t	P	Inference
FVC	3.02±0.43	3.12±0.53	1.19	>.005	Not significant
FEV_1	2.48±0.42	2.59±0.41	1.43	>.005	Not significant
FEV_3	2.99±0.44	3.05±0.43	0.74	>.005	Not significant
PEFR	7.82±0.98	8.03±1.29	1.08	>.005	Not significant
FEF_{25-75}	3.62±0.61	3.84±0.63	1.94	>.005	Not significant
FEF_{2-12}	6.05±1.07	6.51±1.05	2.34	<.005	Significant
FEF_{25}	7.08±0.74	7.54±0.44	3.65	<.001	Significant
FEF_{50}	5.02±0.88	5.50±0.54	3.19	<.001	Significant
FEF_{75}	2.58±0.52	2.66±0.64	0.81	<.005	Significant

Table 13: Comparison of different parameters of Pulmonary Function in Non-smokers and Quitters (Mean±SD)

Pulmonary functions	Passive Smokers N=336	Non-smokers N=132	t	P	Inference
FVC	2.58±0.51	2.85±0.64	4.05	<.001	Highly significant
FEV_1	2.09±0.48	2.35±0.52	4.42	<.001	Highly significant
FEV_3	2.53±0.51	2.77±0.58	3.76	<.001	Highly significant
PEFR	6.79±1.34	7.41±1.50	3.72	<.001	Highly significant
FEF_{25-75}	3.30±0.69	3.63±0.67	4.06	<.001	Highly significant
FEF_{2-12}	5.29±1.23	6.00±1.25	4.82	<.001	Highly significant
FEF_{25}	6.22±1.23	6.96±1.00	6.10	<.001	Highly significant
FEF_{50}	4.61±0.74	5.15±0.74	6.13	<.001	Highly significant
FEF_{75}	2.33±0.51	2.58±0.59	3.88	<.001	Highly significant

Table 14: Comparison of different parameters of Pulmonary Function in Non-smokers and Passive Smokers (Mean±SD)

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Pulmonary functions	Smokers N=336	Quitters N=38	t	P	Inference
FVC	2.84±0.44	3.02±0.43	2.45	<.05	Significant
FEV_1	2.34±0.41	2.48±0.42	1.95	<.05	Significant
FEV_3	2.81±0.45	2.99±0.44	2.38	<.05	Significant
PEFR	7.46±0.97	7.82±0.98	2.14	<.05	Significant
FEF_{25-75}	3.39±0.62	3.62±0.61	2.19	<.05	Significant
FEF_{2-12}	5.64±0.92	6.05±1.07	2.24	<.05	Significant
FEF_{25}	6.43±0.67	7.08±0.74	4.99	<.001	Highly significant
FEF_{50}	4.71±0.67	5.02±0.88	2.10	<.05	Significant
FEF_{75}	2.34±0.52	2.58±0.52	2.09	<.01	Highly significant

Table 15: Comparison of different parameters of Pulmonary Function in Smokers and Quitters (Mean±SD)

Pulmonary functions	Smokers N=336	Passive Smokers N=62	t	P	Inference
FVC	2.84±0.44	2.91±0.48	1.08	<.05	Not Significant
FEV_1	2.34±0.41	2.38±0.50	0.59	<.05	Not Significant
FEV_3	2.81±0.45	2.88±0.47	1.09	<.05	Not Significant
PEFR	7.46±0.97	7.58±1.30	0.69	<.05	Not Significant
FEF_{25-75}	3.39±0.62	3.53±0.70	1.47	<.05	Not Significant
FEF_{2-12}	5.64±0.92	5.75±1.22	0.67	<.05	Not Significant
FEF_{25}	6.43±0.67	6.81±0.76	3.49	<.01	Significant
FEF_{50}	4.71±0.67	4.95±0.67	2.59	<.01	Significant
FEF_{75}	2.34±0.52	2.42±0.55	1.06	<.05	Significant

Table 16: Comparison of different parameters of Pulmonary Function in Smokers and Passive Smokers (Mean±SD)

Pulmonary Functions Number	Smokers (336)	Non-Smokers (132)	Passive Smokers (62)	Quitters (38)
Age(mean)	37.60±12.10	38.80±12.60	37.42±12.90	39.66±12.84
Height	160.89±8062	162.92±7.43	160.84±6.70	161.24±7.86
FVC	2.84±0.44	3.12±0.53	2.91±0.48	3.02±0.43
FEV_1	2.34±0.41	2.59±0.41	2.38±0.50	2.48±0.48
PEFR	7.46±0.97	8.03±1.29	7.58±1.30	7.82±0.98
FEF_{25-75}	3.39±0.62	3.84±0.63	3.53±0.70	3.62±0.61
FEF_{2-12}	5.64±0.92	6.51±1.05	5.75±1.22	6.05±1.07

Table 17: Comparison of different parameters of Pulmonary Function in Smokers, Non-smokers, Passive Smokers and Quitters (Mean±SD)

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Group	Age Group	Number	FVC	FEV_1	PEFR	FEF_{25-75}	FEF_{2-12}
Smokers	<35	152	2.94±0.41	2.50±0.40	7.88±0.93	3.82±0.47	6.21±0.90
	35-45	72	2.84±0.31	2.34±0.22	7.54±0.51	3.33±0.38	5.80±0.68
	>45	112	2.67±0.45	2.11±0.37	6.87±0.90	2.82±0.43	4.76±0.80
Quitters	<35	11	3.30±0.50	2.75±0.48	8.24±1.13	4.18±0.45	6.97±1.00
	35-45	11	3.00±0.26	2.52±0.26	7.86±0.46	3.85±0.22	6.25±0.33
	>45	16	2.82±0.39	2.26±0.33	7.50±0.80	3.07±0.42	5.73±0.65
Non-Smokers	<35	52	3.40±0.54	2.86±0.30	8.33±1.70	3.82±0.47	6.21±0.90
	35-45	30	3.02±0.30	2.53±0.30	8.09±0.51	3.66±0.24	6.18±0.63
	>45	50	2.86±0.30	2.30±0.34	7.61±0.94	3.28±0.45	5.58±0.60
Passive Smokers	<35	28	3.15±0.41	2.65±0.38	8.27±0.84	4.15±0.37	6.57±1.23
	35-45	14	2.93±0.47	2.24±0.35	7.46±1.80	3.32±0.19	5.56±0.39
	>45 M	20	2.54±0.37	2.10±0.37	6.95±0.53	2.74±0.30	4.70±.56

Table 18: Comparison of Pulmonary Function in adults, middle aged and late middle aged Smokers, Non Smokers, Passive Smokers and Quitters (Mean±SD)

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