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The impact of cigarette smoking on lung function in smokers with differences in their nicotine dependency

***Glad Mohesh M. I.[1], Sundaramurthy A.[2] and Prema Sembulingam[3]**

[1]Assistant Professor, Department of Physiology, Shri Sathya Sai Medical College & RI, Ammapettai, Sembakkam Post, Kancheepuram District, Tamilnadu.603108
[2]Professor & Head, Department of Pulmonary Medicine, Shri Sathya Sai Medical College & RI, Ammapettai, Sembakkam Post, Kancheepuram District, Tamilnadu.603108
[3]Former Professor of Physiology, Madha Medical College & Research Institute, Kuntrathur, Chennai
Correspondence Email : gladmohesh@gmail.com

ABSTRACT

Exposure to the multiple toxins in tobacco smoke causes disease. Nicotine in tobacco plays a minor role, however addiction is the proximate cause for these smoke related diseases. Nicotine dependency leads to addiction that sustains the habit of tobacco smoking. To estimate the effect of nicotine dependency on the lung function of three different groups of asymptomatic tobacco smokers using spirometry. Institutional Ethics Committee approval was obtained. Adult male cigarette smokers (n=195) were recruited for this study based on their Fagerstrom's nicotine dependence test score and were divided into four groups of 65 in each: Group I-less dependent, Group II-moderately dependent and Group III-highly dependent. Non-smokers(n=70) were selected as control group. After an overnight abstinence from tobacco use, the subjects were examined for their anthropometric parameters. Spirometry was done using RMS Helios 401,a PC based spirometer and the data were saved for later analysis. One way ANOVA with post hoc Tukey test was done using SPSS v17.0 with statistical significance set at $p<0.05$. Gradual and statistically significant decline in the spirometry was noticed. FEV1 values declined from control to group III($p<0.001$). FVC values showed a negative correlation against increasing nicotine dependency. FEV1/FVC ratio, though showed a significant decrease($p<0.001$) across the groups, it failed to categorize them with any COPD as the ratio was not <70% as per the new guidelines. Nicotine dependency worsens the respiratory functional status of the smoker. Increased nicotine addiction indirectly damages the lung function which can be brought down only by ceasing the tobacco use.

Key words: smoking, nicotine dependency, spirometry

INTRODUCTION

Globally, India stands second to China in the total number of smokers. Recent findings showed a huge growth in adult male smokers in the country. Within a period of 17 years the statistics has grown high from 79 million's to 108 million[1]. But, the 'quit-rate' is very low (only 5%).It is alarming to note the lower rate of quitting not compensating the higher rate of new smokers[2].

Exposure to the multiple toxins in tobacco causes diseases. However, content of the main toxin viz., nicotine in tobacco plays only a minor role. The main danger in the smoke related diseases lies not in the quantity of nicotine as such but the slow development and dependency of the people for nicotine [2]. As cigarettes are costlier compared to other tobacco products like bidis and dipping tobacco, the young male population is shifting from costly cigarettes to these cheaper products landing themselves into more trouble. The fact that they are ready to shift over to cheaper

products but not to quit it, is the proof to say that nicotine dependency plays the main role in continuing the smoking. Thus, all the problems related to the smoke in the smokers are basically the addiction to nicotine and not the cigarette itself. .

Based on this fact, we attempted to find out the effect of nicotine dependency on the lung function status irrespective of the number of cigarette packs per year. We used Fagerstrom's nicotine dependency test (FTND) score to categorize the smokers into low, moderate and high nicotine dependents[3].The FTND measures the nicotine dependence quantitatively and thus it differs from the other systems of classification like International classification of diseases[ICD] and Diagnostic and statistical manual of mental disorders[DSM][4].However the number of cigarettes per day in the FTND itself is found to be a better item than the whole of the FTND questionnaire[5].Hence we chose this FTND to categorize our subjects based on their scores.

Objectives

Thus, the objective of this project was to estimate the effect of less, moderate and high nicotine dependency on the functional status of the lungs in asymptomatic tobacco smokers using spirometry.

MATERIALS AND METHODS

Institutional ethical committee clearance was obtained. Considering the prevalence rate of 14.2% daily smokers in Tamil Nadu as reported in the Global adult tobacco survey (GATS India,2010) report [6] and with a power of 80% and a 5% alpha error,the sample size calculated was 195.The study participants were recruited from the nearby villages of Shri Sathya Sai Medical College and Research Institute at Ammapettai. The subjects were explained about the study protocol and questions raised by them were cleared. Written informed consent was obtained from each one of them.

Based on their Fagerstrom's nicotine dependence test score[3]subjects were divided into three groups of 65 subjects in each: Group I-less dependent(score 0-3), Group II-moderately dependent(score 4-6) and Group III-high dependent(score 7-10). Age matched non-smokers (n=70) served as the controls. After an overnight abstinence from tobacco and any caffeinated or carbonated drinks, subjects were instructed to report in Physiology laboratory. Basic anthropometric data like age, weight to the nearest kilograms(Krup's weighing machine) and height to the nearest centimeters (mobile stadiometer, Easy care, India) were recorded. Pulmonary function testing was performed according to the standards of the American Thoracic society/European Respiratory society task force guidelines[7].Each study participant performed 2 to 3 forced expiratory maneuvers. Best of the three attempts was saved and stored in the RMS Spiro software in the computer for later analysis.

The saved spirograph data was copied into MS Excel sheet from which selected parameters alone were taken for statistical analysis. FEV1, FVC, FEV1/FVC and PEFR values were compared with the controls and between the groups. One way ANOVA with post hoc Tukey's test and Pearson's coefficient of correlation were the statistical tests done using SPSS v17.0. Statistical significance was set at $p<0.05$.

RESULTS

The anthropometric characteristics of the study population were summarized in Table 1.

Study participants were grouped into three main groups based on their FTND test score. Study subjects were matched with controls in terms of age and BMI.

Table 1.Anthropometric characteristics of the study population

Mean± SEM	Control (n=70)	Group I (n=65)	Group II (n=65)	Group III (n=65)	Sig p <
Age (yrs)	28.26±0.63	29.73±0.54	28.91± 0.57	30.46±0.77	0.14
Weight (kgs)	67.00±1.21	65.54±1.23	66.11±1.42	62.50± 2.13	0.27
Height(cms)	164.91±1.21	164.63±0.45	164.76±0.57	161.68±1.27	0.19
BMI(kg/m^2)	25.87±1.65	24.15±0.42	24.27±0.44	24.06±0.94	0.64

$p<0.05$ is considered statistically significant

Spirometric observations of all the selected four parameters were analysed and the results showed a general fall proportionate with the level of nicotine dependency. All the four parameters showed a statistically significant fall across the groups(Table 2).

Table 2. Nicotine dependence and its impact on the lung volumes

Mean± SEM	Control (n=70)	Group I (n=65)	Group II (n=65)	Group III (n=65)	Sig p <
FEV1(L)	2.61+0.09	1.99+0.12	2.11+0.07	2.17+0.06	0.000*
FVC(L)	2.82+0.09	2.50+0.08	2.40+0.06	2.47+0.07	0.001*
FEV1/FVC	86.83+0.90	74.58+1.58	70.01+2.17	79.75+1.93	0.000*
PEFR(L/sec)	6.75+0.21	5.70+0.22	5.72+0.20	5.10+0.22	0.000*

p<0.05 is considered statistically significant, Indicates the level of significance*

We were able to show the significance in the fall of each of the above said parameters in a pronounced way by the post hoc Tukey's test. Here in the figures 1,2,3&4 it is clearly evident that the said parameters had a definite proportionate fall with increasing nicotine dependency in comparison with that of the control .

Fig 1. Effect of nicotine dependency on FEV1

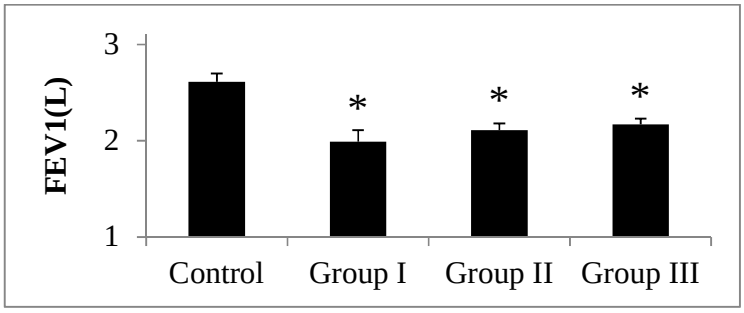


Fig 2. Effect of nicotine dependency on FVC

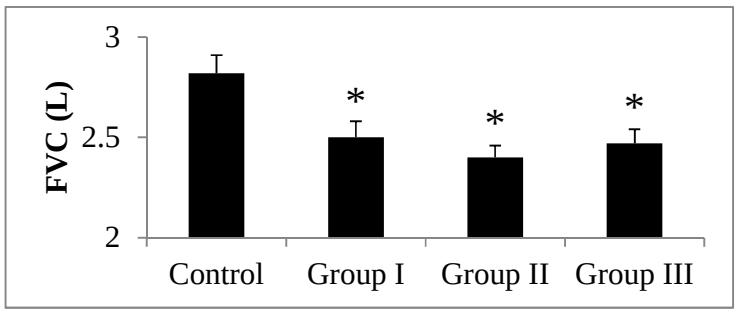


Fig 3. Effect of nicotine dependency on FEV1/FVC ratio

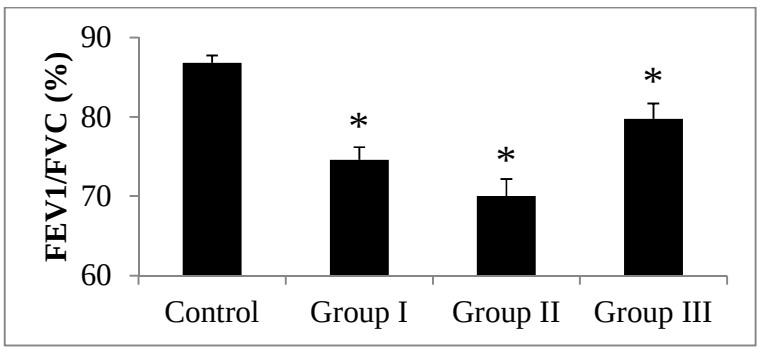
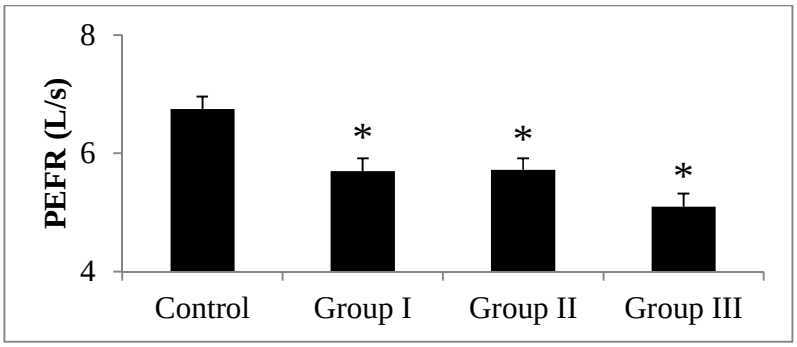


Fig 4. Effect of nicotine dependency on PEFR

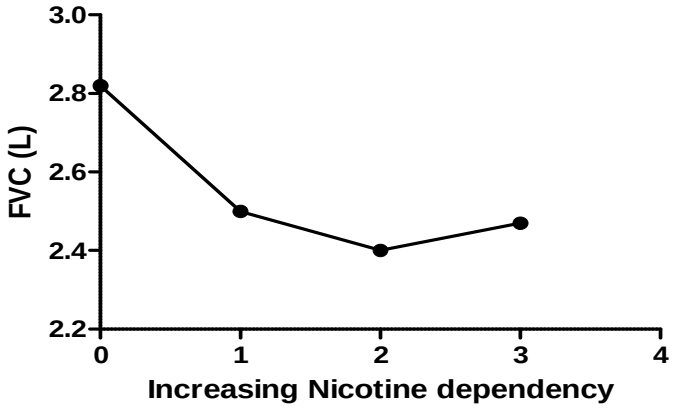


There is a fall in all the spirometric values of low, moderate and high nicotine dependent smokers compared to that of the control groups. The statistical significance of the results confirms the decrease in lung function with increase in nicotine dependency. Pearson's correlation coefficient obtained against nicotine dependency and the FVC values showed a non-significant negative correlation($r=-0.79, p<0.20$) (Fig5).

DISCUSSION

The most important finding of our study was that even asymptomatic but nicotine dependent smokers had decrementing lung function which would be increasing the morbidity and mortality of our population in the very near future. Smoking becomes a high risk factor for diseases such as myocardial infarction, hypertension, diabetes etc. Nicotine, though has a minor role in the smoke, it plays a major role in constant use because it tends to develop the nicotine dependency and addiction. This addiction makes the man to continue smoking again and again which in turn, damages his lungs and decreases his lung functions. Initially, damage remains asymptomatic but in due course it may end up with serious complications like lung cancer.

Fig 5. Negative correlation between the Forced vital capacity and the nicotine dependency
(r = -0.79)



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The association between the nicotine dependence, lung cancer and peripheral arterial disease was recently found to be at the genetic level i.e, in the gene CHRNA3 and CHRNA5 encoding the neuronal nicotinic receptors[8].This is reported by many other studies also [9],[10],[11].Now this throws the light on the evidence that nicotine addiction is capable of affecting the persons at the genetic level and produce the next generation also with the trait of addiction. This is the dangerous mark because it could raise not only the number of smokers but also the morbidity and mortality of any nation.

Cigarette smoking causes persistant low grade systemic inflammation in susceptible individuals[12]. It is a risk factor for diseases like atherosclerosis, muscle loss and cachexia[13, 14]. Decreased FEV1 with increased nicotine

dependency could be due to the indirect effects of increased tobacco smoking [12]. Active smoking and reduced FEV1 is said to have a potential interaction in the pathogenesis of systemic complications observed in these smokers and this forms an additional marker of systemic inflammation too[12].Our results showed a gradual decrease in FEV1 with increase in nicotine dependency explaining the need to control nicotine intake in these smokers in an urgent basis rather than having a 'Quit smoking' campaign. Forced vital capacity(FVC) showed a non-significant negative correlation with the increasing nicotine dependency. Lungs are affected due to the increased smoking to satisfy the nicotine craving.

Nicotine addiction involves an interplay between the pharmacology, learned factors, genetics, social and environmental factors[2].Cigarettes differ in their size, shape, and nicotine content. Nicotine dependency is the prime factor that leads a smoker to smoke again and again, not the number of cigarettes. Our study explored the volume changes in the smokers with differences in their nicotine dependency. We suspect that there is a failure in the policy decisions on tobacco control by raising the tobacco taxation alone: it is not the cost but the nicotine crave that is making these smokers to cross even their economical limits to continue the habit of smoking. We suggest that there would be policies that could completely ban tobacco products of higher nicotine content in addition to the heavy taxation on tobacco products. Reduced nicotine cigarettes to a content of 0.4mg to 0.5mg will prevent the development of addiction and helps the smoker to wean from the habit of smoking[15,16].Also successful quitters had a significantly lower FTND scores that shows that if the nicotine dependency is lowered, the target on tobacco control can be achieved[17].

The decline in PEFR values with respect to the increasing nicotine dependency could be due to the effect of nicotine on the respiratory muscles. However evidences are unclear on it.

CONCLUSION

Our study suggests that the nicotine dependency is the indirect root cause for the declined lung functions of a smoker. Nicotine craving causes the smoker to smoke more and more. Smoking cessation is the only way to get the damaged lung functions recovered; however cigarettes with reduced nicotine would definitely help the smoker himself to quit smoking.

Limitations of the study

The nicotine content in the blood of the smokers was not quantified, however we relied on the FTND score for deriving at the person's nicotine dependency.

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REFERENCES

[1] Mishra S, Joseph RA, Gupta PC, Pezzack B, Ram F, Sinha DN, et al. Trends in bidi and cigarette smoking in India from 1998 to 2015 , by age , gender and education. BMJ Glob Heal. 2016;1:e000005:1–8.
[2] Benowitz NL. Nicotine Addiction. N Engl J Med. 2010;362(24):2295–303.
[3] Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO. The Fagerstrom Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. Br J Addict. 1991;86(9):1119–27.
[4] Fagerström K, Russ C, Yu CR, Yunis C, Foulds J. The fagerström test for nicotine dependence as a predictor of smoking abstinence: A pooled analysis of varenicline clinical trial data. Nicotine Tob Res. 2012;14(12):1467–73.
[5] Breslau N, Johnson EO. Predicting smoking cessation and major depression in nicotine-dependent smokers. Am J Public Health. 2000;90(7):1122–7.
[6] WHO G india. Global Adult tobacco survey,GATS India 2009-2010. 2010.
[7] Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, et al. Standardisation of spirometry. Eur Respir J. 2005;26(2):319–38.
[8] Kaur-Knudsen D, Nordestgaard BG, Bojesen SE, Rempel N, Heyers S, Engels H, et al. CHRNA3 genotype, nicotine dependence, lung function and disease in the general population. Eur Respir J. 1998;103(6):645–53.
[9] Hung RJ, McKay JD, Gaborieau V, Boffetta P, Hashibe M, Zaridze D, et al. A susceptibility locus for lung

cancer maps to nicotinic acetylcholine receptor subunit genes on 15q25. Nature. 2008;452(7187):633–7.
[10] Wang JC, Cruchaga C, Saccone NL, Bertelsen S, Liu P, Budde JP, et al. Risk for nicotine dependence and lung cancer is conferred by mRNA expression levels and amino acid change in CHRNA5. Hum Mol Genet. 2009;18(16):3125–35.
[11] Thorgeirsson TE, Geller F, Sulem P, Rafnar T, Wiste A, Magnusson KP, et al. Supplementary information_A variant associated with nicotine dependence, lung cancer and peripheral arterial disease. Nature. 2010;1(c):1–7.
[12] Wen QG, Man SFP, Sin DD. The interactions between cigarette smoking and reduced lung function on systemic inflammation. Chest. The American College of Chest Physicians; 2005;127(2):558–64.
[13] de Godoy I, Donahoe M, Calhoun WJ, Mancino J, Rogers RM. Elevated TNF-alpha production by peripheral blood monocytes of weight-losing COPD patients. Am J Respir Crit Care Med. 1996;153(2):633–7.
[14] Eid a a, Ionescu a a, Nixon LS, Lewis-Jenkins V, Matthews SB, Griffiths TL, et al. Inflammatory response and body composition in chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 2001;164:1414–8.
[15] Michael Fiore TB. Reduced nicotine cigarettes-a promising regulatory pathway. N Engl J Med. 2015;373(14):1289–91.
[16] Donny EC, Denlinger RL, Tidey JW, Koopmeiners JS, Benowitz NL, Vandrey RG, et al. Randomized Trial of Reduced-Nicotine Standards for Cigarettes. N Engl J Med. 2015; 373(14):1340–9.
[17] Lindberg A, Niska B, Stridsman C, Eklund BM, Eriksson B, Hedman L. Low nicotine dependence and high self-efficacy can predict smoking cessation independent of the presence of chronic obstructive pulmonary disease: a three year follow up of a population-based study.Tobacco Induced Diseases; 2015;13(1):27.