Journal of
Addiction Research & Therapy
ISSN: 2155-6105

Pandey et al., J Addict Res Ther 2017, 8:2
DOI: 10.4172/2155-6105.1000316

Research Article OMICS International

Effect of Smoking in Cognition among Male Medical Students

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Received date: February 23, 2017; **Accepted date:** April 03, 2017; **Published date:** April 10, 2017

Abstract

Introduction: Smokers claim that smoking increases their concentration, alertness, and overall mental performance. On the contrary, evidences point at gradual cognitive deterioration in smokers. Cognitive deterioration can be assessed by Montreal cognitive assessment (MoCA).

Objective: To compare the cognitive status in smoker and non-smoker medical students.

Materials and methods: A cross-sectional comparative study was done in 46 male medical students with normal cardiac and pulmonary functions (23 smokers and 23 non-smokers, FTND was used to establish smoking status) at Pulmonary Function Lab in the Department of Basic and Clinical Physiology, BP Koirala Institute of Health Sciences. Pulmonary function tests (PFT) were measured to exclude pulmonary function defect. Blood Pressure (SBP and DBP) was used to ascertain subjects with normal and abnormal cardiac function. For cognition assessment Montreal cognitive assessment (MoCA), which is a close ended questionnaire, was used. Data were expressed in median and Inter-Quartile-Range (IQR). Chi-square Test was applied to observe association between smoking and cognition (normal vs. impaired cognition).

Results: All baseline variables viz., anthropometric (Age and BMI), cardiovascular (Diastolic and Systolic Blood Pressures) and pulmonary function (VC, FEV1 and FEV1/FVC) were comparable between smokers and non-smokers except age. Greater percentage of smokers compared to non-smokers (48% vs. 22%) had mild cognitive decline as measured by MoCA score. However, the finding was statistically non-significant (0.063).

Conclusion: Low nicotine-dependent male medical students with normal pulmonary and cardiac functions, showed mild but insignificant cognitive decline as measured by MoCA score.

Keywords: Cognition; Pulmonary function; Smoking

Introduction

Smoking status has been established as a risk factor for non-communicable diseases, which are one of the prime causes of death and disability of millions of people year in and year out [1]. The World Health Organization (WHO) has also predicted that 1.5 to 1.9 billion people worldwide will be smokers by 2025. Smoking continues to rise in especially in developing countries. Impact of smoking on respiratory and cardiovascular system has already been well established. However, its effect on central nervous system still remains contradictory. Most of the studies were inconclusive about the effect of smoking on cognition [2]. Nicotine is a potent addictive agent in cigarettes. Smokers link it to increased alertness, concentration and overall mental performance [3,4]. Neuro-imaging studies have shown that Nicotine induces enhanced activity in some regions involved with attention and cognition viz., thalamus, lateral frontoparietal cortices, anterior cingulate cortex whereas decreasing activity in other regions involved with task-irrelevant mental operations such as mind-wandering; ventromedial prefrontal cortex, posterior cingulate cortex, parahippocampus [5-7]. Whereas studies show gradual cognitive decline in smokers [8,9]. Among different available cognitive tests, Montreal cognitive assessment (MoCA), a one-page, 30-point test administered in approximately 10 min, is one of the sensitive and valid tools to assess even mild cognitive impairment [10]. Our study aimed to see the relation between smoking and cognition in young male medical students without any chronic cardio-respiratory impairment as yet. We hypothesized that smoking causes cognitive decline even in early years of life.

Methods

The study was carried out at the Pulmonary Function Lab, Department of Basic and Clinical Physiology of BP Koirala Institute of Health Sciences (BPKIHS). Sampling frame (population) was male medical (MBBS) students in the institute. However, participants with history of DM-1/2, HTN, COPD, Bronchial Asthma, Psychiatric medication or with positive family history of Parkinsonism/ Alzheimer's were excluded. Those using tobacco in other forms than smoking were also excluded from the study. Only male medical students, aging 20-40 years, with BMI<25 kg/m^2 without history of

sedative/hypnotic use (within recent one week) or abuse, were enrolled. Those, satisfying eligibility criteria, who have been smoking for more than one year, were categorized "smoker" and those who have never smoked were categorized as "non-smoker".

Consecutive convenience snow-ball sampling method was employed as the sampling technique. Sample size was calculated using OpenEpi, Version 3, open source calculator-SS Propor.

Sample size n=[DEFF*Np(1-p)]/[(d2/Z21-α/2*(N-1)+p*(1-p)]=46 (23 smokers, 23 non-smokers) where,

Population size, Eligible male (N): 200

Hypothesized % frequency of outcome factor in the population (p): 4%

Confidence limits as % of 100 (d): 5%

Design effect (DEFF): 1

Protocol of the study was approved by the Institute's Ethical Review Board, BPKIHS, Dharan, Nepal, before starting the study.

The cardiovascular variables, i.e., systolic blood pressure (SBP) and diastolic BP (DBP) were measured in the dominant hand in sitting position at rest. Then Pulmonary Function Test (PFT) was done using CHESTGRAPH HI-101 spirometer system (Chest M.I., Inc., Tokyo, Japan). The variables measured in the study were vital capacity (VC), forced expiratory volume in first second (FEV1) and ratio of forced expiratory volume in first second to forced vital capacity (FEV1/FVC). To measure these variables, the subjects were instructed to inhale and exhale through the mouth, holding the disposable mouthpiece between the teeth. Nose-clips were used to ensure that the subject breathed entirely from the mouth. At first the participants had to inhale and exhale normally two times. Then the subject had to inspire maximally and expire forcefully so that all his expiratory muscles during forceful expiration were contracted. Then again he had to inhale and exhale normally. Emphasis was given on the maximum effort on behalf of the subject. The ambient temperature, age, sex, height, weight and race of the subject were measured and entered in the spirometer.

The nicotine dependence among smokers was assessed by Fragerstrom Test for Nicotine Dependence (FTND) questionnaire. This questionnaire classified the smokers into 5 categories that are:

- 0-2 very low dependence
- 3-4 low dependence
- 5 medium dependence
- 6-7 high dependence
- 8-10 very high dependence.

To assess cognitive function, Montreal Cognitive Assessment (MoCA) was used. The MoCA test is a one-page, 30-point test administered in approximately 10 min. The MoCA measures following aspects of cognition viz., short-term memory recall, visuospatial abilities, executive functions, attention, concentration and working memory, language and orientation.

Statistical Analyses

Statistical software SPSS ver.21 (SPSS INC., Chicago, ILL, USA) was used for statistical analysis. Since the data obtained was non Parametric, Mann Whitney U test was applied to compare the variables between the groups. Association was sought between smoking status and cognition scores using Fisher's Exact Chi-square test. Significance level at $p<0.05$ was considered.

Results

Baseline anthropometric, cardiovascular and pulmonary functions were comparable between smokers and non-smokers as p-value determined by Mann-Whitney test were non-significant, however, age between the two groups were significantly different (Table 1).

Variable	Smoker Median (IQR)	Non-smoker Median (IQR)	P Value
Anthropometric Variables			
Age (years)	22 (21-22)	21 (20-22)	0.001
BMI (Kg/m^2)	23.53 (22.4-25.7)	22.09 (20.5-25.3)	0.104
Cardiovascular Variables			
SBP mm Hg	120 (120-130)	120 (120-120)	0.082
DBP mm Hg	80 (70-80)	80 (70-80)	0.644
Pulmonary Function			
VC (litres, L)	3.97 (3.53-4.76)	4.26 (3.83-4.66)	0.709
FEV1 (litres, L)	3.81 (3.47-4.71)	4.17 (3.58-4.44)	0.775
FEV1/FVC	98.09 (95.72-99.09)	95.3 (92.5-98.2)	0.202

Table 1: Baseline anthropometric, cardiovascular and pulmonary function variables, BMI=Body Mass Index, SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, VC=Vital Capacity, FEV1=Forced Expiratory Volume in 1st s, FEV1/FVC=Ratio of Forced Expiratory Volume in 1st s to Forced Vital Capacity, $p<0.05$ is statistically significant.

All smokers in the study, as determined by FTND score, fell under low-nicotine dependence.

Compared to non-smokers, greater percentage of smokers had mild cognitive decline as measured by MoCA score. However, the finding was statistically non-significant (Table 2).

Cognitive Status	Smoker (%)	Non-smoker (%)	P value
Normal Cognition (MoCA score>26)	12 (52)	18 (78)	0.063
Mild Cognitive Impairment (MoCA score 22-25)	11 (48)	5 (22)	

Table 2: Fisher's exact chi-square test showing association between smoking status and cognitive status.

Discussion

Though insignificant, our study directed towards mild cognitive decline even in low nicotine dependent young population. We have

mixed literature to support and to refute for the finding. Nicotine, Anabasine and Anatabine in cigarette are considered to improve cognition in terms of memory and attention [11]. Dumatar and Chauhan showed definite improvement in memory with smoking [12]. However, studies by Kalmijn et al. [13] and Ernst et al. [14] did not show any association between smoking and cognition. In addition, Vajravelu et al. and Hill et al. showed decreased cognitive performance in young adult smokers [15,16].

Most studies showing decline in cognition with smoking were done in older and long-term smokers [17,18]. Decline in cognition is especially seen in those with diminished pulmonary functions which are inevitable consequences of long-term smoking. Therefore, decline in cognition may have some relationship with duration of smoking, hypoxia and different harmful substances in tobacco smoke.

Limitations

Only few (46) low nicotine-dependent young (20s) male medical students were enrolled for short duration (2 weeks).

Conclusion

Low nicotine-dependent male medical students with normal pulmonary and cardiac functions, showed mild but insignificant cognitive decline as measured by MoCA score in a small analytical cross-sectional study.

Acknowledgement

We are thankful to all the members of Department of Basic and Clinical Physiology, Dr. Shrijana Dahal, Department of Community Dentistry and Mr. DB Baral, Department of Community Medicine including all participants for successful conduction of the study.

Conflict of Interest

The authors declare that they have no competing interests.

Funding

None.

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