The Effect of Smoking (Cigarette and Marijuana) on Peak Expiratory Flow Rate

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ABSTRACT

Smoking has been recognized as a major risk factor for respiratory diseases especially, chronic obstructive airway disease, lung cancer and cardiovascular diseases. This study was undertaken to investigate the effects of smoking (cigarette and marijuana) on the peak expiratory flow rate among undergraduates. The study was carried out at both campuses (Igbariam and Uli) of Chukwuemeka Odumegwu Ojukwu University, Anambra state. Three hundred and fifty (350) students participated in the study after informed consent was obtained. The respondents were divided into four groups. Group A consisted of cigarette smokers. Group B was marijuana smokers. Group C was cigarette and marijuana smokers. Group D was control (non-smokers). Questionnaires were distributed to the respondents. ASSESS peak flow meter (RESPIRONICS, U.S.A) was used to measure peak expiratory flow rate (PEFR). The results revealed that cigarette smokers had a mean PEFR of 396 ± 12 LPM. Marijuana smokers had a mean PEFR of 586 ± 16 LPM. Cigarette and marijuana smokers had a mean PEFR of 555 ± 20 LPM. The control (non-smokers) had a mean PEFR of 506 ± 12 LPM. Cigarette smoking significantly decreased PEFR, while marijuana smoking had a positive effect on PEFR.

Keywords: Smoking, marijuana, cigarette, PEFR, and non-smokers

INTRODUCTION

Cigarette smoking is rampant across the globe. It is a dangerous practice that is associated with serious health hazards. Manufacturers of tobacco spend huge sums of money in advertising in order to maintain their market share. Youths are the target population. They have continued to smoke despite warnings. This is principally because smoking is associated with addiction. Many countries have taken steps to control the consumption of tobacco with usage and sales restrictions; including warning messages printed on packaging. Tobacco smoke contains nicotine and several carcinogenic chemicals. Nicotine is highly addictive psychoactive drug. Therefore cigarette smoking results in the nicotine content causing physical and psychological dependence (Nichter et al., 1991).

According to World Health Organization (WHO, 2008)) tobacco use is the single greatest cause of preventable death globally. Cigarette smoking is a major risk factor for chronic obstructive pulmonary disease (COPD), emphysema, cardiovascular diseases, cancers of the larynx and mouth (Villeneuve and Mao, 1994). High mortality has been associated with smoking. Each cigarette that is smoked is estimated to shorten life by an average of 11 minutes (BBC News, 1999). Smokers are three times as likely to die before the age of 60 or 70 unlike non-smokers (Doll et al., 2004; Mamun et al., 2004; Thun et al., 1995).

Marijuana (*Cannabis sativa*) is often consumed for its mental and physical effects, such as 'high' or 'stoned' feeling, a general change of conscious perception, heightened mood. Onset of effects is within minutes when smoked and about 30 minutes when eaten as a cooked cannabis edible (Riviello and Ralph, 2010). It is typically smoked with larger puff and inhaled volumes and approximately five times longer breath-holding times than tobacco cigarettes of the same weight, resulting in about four times greater deposition of tar in the lung (Wu et al., 1988). The volatile and particulate phase components of the smoke from each are qualitatively similar, with the major exceptions being that tobacco contains nicotine not found in marijuana and marijuana contains more than 60 cannabinoid compounds not found in tobacco (Douglas et al., 2015).

Peak Expiratory Flow Rate (PEFR) is a useful parameter to monitor airway obstruction, assess its severity and variation and evaluate the effects of treatment (ATS, 1994; Birajdar et al., 2016). PEFR measures the maximal airflow rate achieved while forcefully expelling air from the lungs, following maximal inspiration. Tests of PEFR reflect changes in airways caliber, often expressed as liters/minute (Sagher et al., 1999). This research was undertaken to evaluate the effects of smoking (cigarette and marijuana) on peak expiratory flow rate among students of Chukwuemeka Odumegwu Ojukwu (at both Uli and Igbariam campuses). Anambra state, Nigeria.

MATERIALS AND METHOD

Study Area

The research was carried out at Chukwuemeka Odumegwu Ojukwu University, Uli and Igbariam campuses. The university operates a two-campus system with the main campus at Igbariam. 350 students were recruited into the study after informed consent was obtained.

Instrument of Data Collection

- Questionnaire. A questionnaire was designed to capture the following relevant information: age, gender, height, department, smoking habit and duration
- Peak flow meter. **ASSESS** peak flow meter (RESPIRONICS, U.S.A) was used. A peak flow meter is an apparatus used to measure the flow of air as it is expelled from the lungs.
- A tape rule. The tape rule was used to measure the height of the respondents. This is necessary because the peak flow meter has specific height in which measurements are to be taken

Method of Data Collection

During data collection, the following procedure was employed. Two trained research assistants went to the different lodges and hostels located at both Uli and Igbariam campuses of the university. A student who willingly agreed to participate in the study was given a questionnaire to fill. The tape rule was used to measure his height. Before an individual was tested with the peak flow the height and age were recorded, so as to determine the average points in which the markers were to be placed. The apparatus was made up of 3 markers which were colored

Green	→	Good
Yellow	→	Average
Red	→	Bad.

A person using the apparatus would expire air 3 times. The first trial is known as the testing phase while the second and third trials are the phases that would be taken into consideration with the mean recorded.

Ethical Consideration

Those who were recruited into the study willingly gave their informed consent. The procedure was explained to them. Steps were taken to ensure good hygiene when using the apparatus. The study was approved by the Ethical Committee of Faculty of Medical Sciences, Chukwuemeka Odumegwu Ojukwu University, Uli campus.

Experimental Design

The participants were divided into four groups: Group A (Cigarette smokers=100); Group B (Marijuana smokers, n=100); Group C (Cigarette and Marijuana smokers, n=100); Group D (Control, n=50).

Statistical Analysis

The data obtained were entered in a Microsoft Excel spreadsheet, in which tables were constructed. Parameters such as mean, percentages and standard

deviations were calculated. The student's t-test was applied and p-values were determined. Differences were considered significant at $p < 0.05$

RESULTS

The results showed that those within the age range of 19-24 was 280 (80%), 25-30 age range was 58 (16.6%), above 30 age range was 12 (3.4%). The age range with the highest percentage of respondents was 19-24, as illustrated in table 1.

Table 1: Showing age distribution of the respondents

Age range	Number	Percentage (%)
19-24	280	80
25-30	58	16.6
31 & above	12	3.4

The number of respondents that smoked above 2 sticks of cigarette per day was 65 (18.6%), while the number that smoked occasionally and less than 2 sticks per day was 85 (24.3%). The number of respondents that

smoked above 2 wraps of marijuana per day was 137 (39.1%), while the number that smoked occasionally and less than 2 wraps per day was 63 (18%). This is illustrated in table II.

Table II: Showing quantity smoked (cigarette and marijuana)

	Above 2 per day	Occasionally, less than 2 per day
Cigarette	65 (18.6%)	85 (24.3%)
Marijuana	137 (39.1%)	63 (18%)

Respondents who had smoked for the duration of 0-1 year were 49 (14%). Those whose duration was 2-4 years were 121 (34.6%). Respondents who had smoked for 5yrs and above were 80 (22.9%), as illustrated in table III.

Table III: Showing duration of smoking

Years	Number	Percentage (%)
0-1	49	14
2-4	121	34.6
5 & above	80	22.9

The peak flow readings were recorded in liter per minute (LPM). These varied among the different groups. Group A (Cigarette smokers) had a mean value of 396 ± 12 LPM. Group B (Marijuana smokers) had a mean value of

586 ± 16 LPM. Group C (Cigarette and Marijuana smokers) had a mean value of 555 ± 20 LPM. Group D (Control) had a mean value of 506 ± 12 LPM, as illustrated in table IV.

Table IV: Showing Peak Expiratory Flow Rates (PEFR)

Groups	PEFR (L/Minute)	P-value relative to control
A (Cigarette smokers)	396 ± 12	0.01
B (Marijuana smokers)	586 ± 16	0.01
C (Cigarette and Marijuana smokers)	555 ± 20	0.03
D (Control)	506 ± 12	

DISCUSSION

The effect of smoking on peak expiratory flow rate (PEFR) was investigated. The results showed variations among the different groups of respondents. Group B (Marijuana smokers) had the highest mean value of 586 ± 16 LPM, followed by Group C (Marijuana and Cigarette smokers) with mean value of 555 ± 20 LPM. Group A (Cigarette smokers) had the lowest mean value of 396 ± 12 LPM. The peak flow meter has three indicators: Green, Yellow, and Red. The green indicator indicates good expiratory airflow, the yellow indicates moderate while red indicates bad expiratory airflow. With the average age and height of this study, the good was 594 LPM, the moderate was 475 LPM and the bad was 297 LPM. Cigarette smokers were within the red indicator (396 ± 12 LPM). Group B were within the yellow indicator range, though close to the green indicator (586 ± 16 LPM). Group C respondents were within the yellow indicator range (555 ± 20 LPM). Group D had value within the yellow indicator range. Our control varied from the normal value of the manual. This may be due to differences in the population.

In comparison, the average PEFR of cigarette smokers was low compared with that of marijuana smokers. Although marijuana and tobacco have similar amounts of volatile and tar components, the pulmonary effects differ (Tashkin, 2013). Marijuana exposure has an immediate and modest bronchodilator effect with a subsequent increase in airway inflammation and symptoms of chronic bronchitis. The results showed that the PEFR of marijuana smokers was significantly higher than that of the control subjects. This is due to the fact that short term use of marijuana is associated with bronchodilation (Tetrault, 2007). The acute bronchodilator effect appears to be due to tetrahydrocannabinol (THC), the psychoactive ingredient in marijuana (Kempker et al., 2015).

The PEFR of cigarette smokers was significantly lower than that of the control subjects. This is due to the fact that cigarette smoke exposure has irritant effects which can induce acute bronchospasm by stimulating airway cholinergic reflex mechanisms (Nadal and Comroe, 1961).

In this present study marijuana smokers had higher PEFR than Group C (Cigarette and Marijuana smokers) which was higher than the control subjects. Whereas acute marijuana exposure has consistently been associated with improvements in forced expiratory volume (FEV1), peak flow measurements, and airway conductance (Tetrault et al., 2007), long-term use of smoked marijuana has been linked with symptoms of chronic bronchitis (Tashkin et al., 1987), some decrease in lung function (Tashkin, 2013; Tetrault et al., 2007).

CONCLUSION

Marijuana has a positive effect on PEFR. This may be due to the tetrahydrocannabinol (THC) it contains.

Cigarette smokers had significantly decreased PEFR compared with control subjects. This could be due to the irritant effects of the components of tobacco on the airways. Despite the apparent positive effects of marijuana smoke on PEFR, prolonged exposure to marijuana smoke (based on number of years consumed) is associated with chronic respiratory symptoms like chronic cough, sputum production, wheeze, chest tightness and dyspnea followed by reduced expiratory airflow (Douglas et al., 2015).

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