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A Cross-sectional Study on Olfactory Function among Young Adult Smokers

ABSTRACT

Objective: To determine the olfactory function and/ or dysfunction of young adults who are cigarette smokers using a locally validated smell identification test.

Design: Cross-sectional study

Setting: Tertiary hospital in Metro Manila

Patients: The volunteer study group was composed of 60 male and 21 female students and employees of a tertiary hospital and its affiliated medical school (both in Quezon City). All subjects were young adults within the age range of 20-35 years with a mean age of 27.58 years (± 4.33). All the subjects were currently smoking cigarettes with no medical history of recent viral infection, nasal/sinus surgery, nasal/brain tumors, head trauma, radiotherapy, chronic rhinitides in exacerbation or tracheostomy. Olfactory function of each subject was evaluated using the Sto. Tomas Smell Identification Test (ST-SIT) which is a locally-validated test.

Results: Majority of the subjects fell within the 24-27 age group with a mean age of 27.58 years (± 4.33). Males outnumbered females 74.1% as against 25.9%. An inverse relation between pack years and ST-SIT score was present indicating that there could be a dose-related effect of cigarette smoking on olfactory function.

Among the 81 subjects, 15 (18.5%) turned out to be anosmic, 46 (56.7%) were hyposmic and 20 (24.6%) had normal olfactory function. A mean ST-SIT score was computed at 81.183 (± 12.58), indicating that majority of the subjects had olfactory dysfunction, meaning they were hyposmic.

Conclusion: Smoking cigarettes has become part of the lifestyle of a lot of people in spite of its hazards to health. In the present study, a majority of supposedly healthy young adults who currently smoked cigarettes were proven to suffer from olfactory impairment based on the scores of a locally-validated smell identification test. An inverse relation between ST-SIT scores and pack years was also noted which may indicate a dose-related effect of smoking on olfactory function.

Keywords: *Olfaction, Smoking,, Hyposmia, Anosmia*

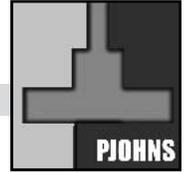
THERE is a dearth of information on the influence of smoking on the ability to smell. Several studies have shown the adverse effect of cigarette smoking on smell function while others found no correlation between smoking and smell function^{7,8}. To the best of our knowledge, there are no locally-published studies on the topic.

Olfactory problems can have a significant impact on our lives. A person with a faulty sense of smell and taste is deprived of an early warning system that most of us take for granted³. Smell and taste alert us to fires, poisonous fumes, leaking gas, and spoiled foods. Loss of the sense of smell

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**Table 1** - Age, Sex and Pack Years Distribution in relation to Olfactory Function

	Normal		Hyposmia		Anosmia	
	n=20		N=46		n=15	
Sex						
Male	13	65.0%	36	78.3%	11	73.3%
Female	7	35.0%	10	21.7%	4	26.7%
Age group						
20 – 23	4	20.0%	10	21.7%	4	26.7%
24 – 27	14	70.0%	12	26.1%	0	0.0%
28 – 31	2	10.0%	13	28.3%	3	20.0%
> 31	0	0.0%	11	23.9%	8	53.3%
Pack Years						
5 and below	18	90.0%	35	76.1%	4	26.7%
6 - 10 years	2	10.0%	6	13.0%	7	46.7%
11 - 15 years	0	0.0%	3	6.5%	3	20.0%
More than 15	0	0.0%	2	4.3%	1	6.7%

Table 2 Measures of Central Tendencies and Dispersion in relation to Olfactory Function

	Normal	Hyposmia	Anosmia
Age (years)			
Mean	25.10	27.89	29.93
SD	1.80	4.17	5.63
Median	25.00	28.00	32.00
Range	22 - 29	22 - 35	20 - 35
SIT Score			
Mean	95.28	81.65	60.97
SD	3.22	6.47	5.75
Median	94.75	84.00	60.00
Range	91 - 104	71 - 90	50 - 68.75
Pack Years			
Mean	3.02	5.05	8.44
SD	1.88	4.48	5.46
Median	2.75	3.10	7.50
Range	1.0 - 6.0	1.25 - 20.0	2 - 22

may also be a sign of sinus disease, growths in the nasal passages or, in rare circumstances, brain tumors. Because an intact sense of smell and taste is required in some professions, chefs and firemen, among others, may be subject to serious handicaps. In addition, this sense provides aesthetic pleasure, as shown by our predilection for the smell of such objects such as flowers, condiments and scented consumer products.

Recent statistics from the WHO have shown that there has been a decline of tobacco use in the developed world while a rise is seen in developing countries, with Asia having the highest smoking rate. In the Philippines, 60% of men smoke, with women catching up fast. Nearly all of them began smoking in their teens, even before reaching the peak of olfactory function. Despite these statistics, little is known regarding the effect of cigarette smoking on the olfactory function in the local setting.

Given the contrasting results in studies relating olfactory function and smoking and paucity of related literature in the local setting, we

attempted this study in the hope of providing local information on the effects of smoking on the much-neglected sense of smell. This study aims to determine the olfactory function and/or dysfunction of young adult smokers using a locally-validated smell identification test.

MATERIALS AND METHODS

Subjects: The volunteer study group was composed of 60 male and 21 female students and employees of a tertiary hospital and its affiliated medical school. These subjects were acquired within a designated 1-month period. All subjects were young adults within the age range of 20-35 years with a mean age of 27.58 years. A written consent was accomplished by all the subjects prior to the procedure.

A complete medical history was obtained and a physical examination with emphasis on nasal endoscopy performed on all subjects to rule out other entities that could impair the function of smell.

All subjects must have been between 20-35 years old, currently smoking cigarettes and did not meet the following exclusion criteria: medical history of recent viral infection, nasal/sinus surgery, nasal/brain tumors, head trauma, radiotherapy, chronic rhinitides in exacerbation or tracheostomy.

Data Collection: Olfactory function was assessed using the Sto. Tomas Smell Identification Test (ST-SIT), a standardized, validated test⁹. This test uses 45 odorants each enclosed in an opaque polyethylene squeeze bottle. This test is able to qualify whether a person is anosmic, hyposmic or has normal olfactory function. Each odorant is smelled by the subject and identified from a written list of choices. The odorant has a corresponding score and the summation of these scores serve to discriminate those with normal olfactory function from those with olfaction problems⁹.

Data Analysis: Study variables included subjects' age, sex, number of sticks per day and number of years smoking. Cigarette dose was calculated in pack years by multiplying the number of packs per day with the number of years smoking. Confounders were controlled by eliminating subjects who fulfilled even one of the exclusion criteria.

All data was processed and analyzed using Epi-Info version 6.04 statistical software (ANOVA and Kruskal-Wallis One Way ANOVA) (CDC: FREeware) and tabulated using Excel (Microsoft).

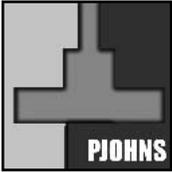
RESULTS

Majority of the subjects fell within the 24-27 age group with a mean age of 27.58 (± 4.33) years. Males outnumbered females 74.1% as against 25.9%. The subjects had mean pack years of 5.18 (± 4.53). Out of the 81 subjects, 49 were members of the hospital staff and 32 were students.

Among the 81 subjects, 15 (18.5%) turned out to be anosmic, 46 (56.7%) were hyposmic and 20 (24.6%) had normal olfactory function. Mean ST-SIT score for all the subjects was 81.18 (± 12.58), indicating that majority of the subjects had olfactory dysfunction, meaning they were hyposmic. 75.2% of the subjects had olfactory dysfunction based on ST-SIT score.

Table 1 summarizes the distribution of age, sex, and pack years in relation to olfactory function.

Table 2 summarizes the different measures of central tendencies



and dispersion in relation to olfactory function.

The age and number of pack years smoked in relation to the olfactory status grouping (normal, hyposmic, anosmic) were found to be statistically significant with p-values: 0.0196 0.0013 for age and pack years respectively using Kruskal-Wallis One Way ANOVA. Correlation coefficient ($r = -0.43$) between the number of pack years and ST-SIT scores was found to have an inverse relationship which may indicate that the effect of smoking on olfactory function is dose-related. The higher the number of pack years, the lower the ST-SIT score.

No statistically significant differences were noted in ST-SIT scores between sex (p-value 0.345) or number of pack years between males and females (p-value 0.0634).

DISCUSSION

The results of this study show that smoking has an effect on olfactory function. Majority (56.7%) of the subjects were found out to be hyposmic while 18.5% were anosmic. A total of 75.2% of subjects had an olfactory deficit based on the scores gathered from the ST-SIT. The 20-35 age group was chosen to eliminate the effect for age since the average ability to identify odors reaches a peak between 20-40 years and begins to decline after this time³. The authors also eliminated any confounders—medical conditions such as recent viral infection, nasal/sinus surgery, nasal/brain tumors, head trauma, radiotherapy, chronic rhinitides in exacerbation and tracheostomy, which could decrease ST-SIT score.

Persons who smoke are nearly twice as likely to have an olfactory deficit than persons who have never smoked¹. The inverse relation between pack years and ST-SIT scores strengthens the findings of Frye et.al.¹ that there is a clear adverse effect of cigarette smoking on olfactory function that is dose-related. However, this effect is reversible to some degree. The reversibility is dependent on the duration of cessation from smoking and the amount of prior smoking activity. The same study showed that restoration of smell function to the level observed in non-smokers requires approximately the same duration as the number of years smoked.

The statistically significant difference between olfactory groups and age seen could be explained by the fact that as a person ages, the number of cigarettes consumed is also increased cumulatively. The age-related olfactory degeneration is a confounder which was eliminated by choosing young adult subjects (25-35 years old).

Certain chemicals in tobacco smoke such as acrolein, acetaldehyde, ammonia and formaldehyde damage olfactory receptor cells in the nose which in turn cause olfactory deficits⁴.

Animal studies done postulate that smell is mediated by olfactory sensory neurons (OSNs) exposed to the nasal airway making them vulnerable to environmental injury and death². Damaged or dead OSNs are replaced to maintain sufficient numbers of neurons. The disruption of this homeostasis has been proven to cause a clinical loss of smell.

The death of OSNs, aptly called apoptosis (programmed cell death) was noted to occur after exposure to tobacco smoke². Tobacco smoke causes a disruption of homeostasis in the olfactory epithelium by increasing apoptotic activity of cells resulting in the net loss of OSNs over

time. As a consequence, the regenerative capacity of the epithelium is overwhelmed causing decreased smell acuity.

Although smoking has been proven to damage olfactory cells causing olfaction problems, all is not lost for cigarette smokers. Some studies show that there is no significant difference between smokers who had quit and non-smokers by subjective olfactometry². In addition, it has been found that there is no elevated risk of olfactory dysfunction for previous smokers when compared with persons who never smoked¹. These findings support the theory that smoking-related olfactory effects are reversible and that the olfactory epithelium is able to recover after smoking cessation. However, the regenerative process is slow, stressing the importance of quitting as early as possible not only to avoid or curtail the health hazards of cigarette smoking but to regain normal olfactory function as well.

Smoking cigarettes has become part of the lifestyle of a lot of people in spite of its hazards to health. In our initial study, a majority of seemingly healthy young adults who currently smoked cigarettes were proven to suffer from olfactory impairment based on the scores of a locally-validated smell identification test. An inverse relation between ST-SIT scores and pack years also noted may indicate a dose-related effect of smoking on olfactory function. A case-control comparison, the inclusion of older age groups, and a larger study population can further strengthen the association between smoking and olfactory dysfunction.

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