

Immediate effects of water-pipe smoking on respiratory mechanics and FENO among young smokers

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Background

Water-pipe smoking (WPS) rates are high worldwide (from 8% in the UK to 33% in Pakistan)¹, especially among young smokers, since it is considered to be less harmful than cigarette smoking, it is of relatively low cost, and also, accompanied by social interaction².



Figure 1. 16% of EU citizens and 32% of the European youth say they have tried water-pipes (Special Eurobarometer 385; Attitudes of Europeans towards tobacco, report. May 2012. Available from: ec.europa.eu)

Recent data demonstrate that WPS immediately causes reduction of peak expiratory flow rate (PEFR) and FEF_{25-75%}, as well as fractional exhaled nitric oxide (FENO) levels in asymptomatic smokers³. However, smoking population include people with and without respiratory complaints, and thus, all smokers cannot be studied as one group. This issue has been addressed by other studies comparing lung function among young subjects with and without mild respiratory complaints^{4,5}, but it has never been applied in studies investigating the immediate response of the respiratory system after smoking.

The purpose of our study was to detect the immediate effects of water-pipe smoking on respiratory mechanics using more sensitive techniques, but also to investigate the possibility of a different acute response of the respiratory system among young smokers with and without mild respiratory complaints.

Methods

50 young smokers (average age=23±4, 32 males, mean pack-years=3.6) using cigarettes (average consumption=7 cigarettes/day) and occasionally cigars (average consumption=1 cigar/week) were recruited from a community setting in Athens, Greece, and voluntarily participated in this study. 25 reported a combination of mild respiratory symptoms (allergic rhinitis, mild cough and mild chest tightness) which were rare and sporadic, elicited by exposure to certain substances, exercise or following respiratory infections (MRS-subgroup). The other 25 had no respiratory complaints (NRS-subgroup). All subjects were free of any kind of diseases (even a common cold during the previous 2 weeks) or current use of any medication and did not undergo pregnancy or lactation.

Table 1: Demographics and baseline spirometric data of total, mild respiratory symptoms (MRS) and non respiratory symptoms (NRS) subgroup participants

Characteristic	All 50 individuals	MRS subgroup (N=25)	NRS subgroup (N=25)	p-value
Males/Females	32/18	15/10	17/8	0.554
Age (years)	23.4 ± 4.2	23.6 ± 3.9	23.2 ± 4.5	0.525
BMI (kg/cm ²)	23.4 ± 3.2	23.9 ± 2.9	23 ± 3.4	0.404
Pack-years	3.6 ± 2.8	3.6 ± 2.6	3.6 ± 2.9	0.747
FVC (% pred.)	101.9 ± 12	99.3 ± 10.6	105.5 ± 10.8	0.112
FEV1 (% pred.)	101.2 ± 12.4	93 ± 9.4	109.5 ± 9.2	<0.0001*
FEV1/FVC (% pred.)	84.5 ± 6.9	80.1 ± 5.6	88.8 ± 5.3	<0.0001*
PEF (% pred.)	96 ± 12.88	93.19 ± 12.34	99 ± 13.09	0.114
FEF _{25-75%} (% pred.)	93.4 ± 26.9	74.2 ± 13.9	112.7 ± 22.3	<0.0001*
FEF _{25%} (% pred.)	98 ± 21.25	88.43 ± 16.59	111 ± 16.61	<0.0001*
FEF _{50%} (% pred.)	95 ± 24.96	78.6 ± 14.63	114 ± 19.93	<0.0001*
FEF _{75%} (% pred.)	94 ± 38.43	72.79 ± 20	118 ± 39.6	<0.0001*

Data presented as mean ±SD. Abbreviations: SD = Standard Deviation, N=corresponding number of subjects, BMI=Body Mass Index, FVC=Forced Vital Capacity, FEV1=Forced Expiratory Volume in 1 sec., PEF= Peak Expiratory Flow, FEF_{25%-75%}=Expiratory Flow at 25% to 75% of exhaled vital capacity, FEF_{25%}=Expiratory Flow at 25% of exhaled vital capacity, FEF_{50%}=Expiratory Flow at 50% of exhaled vital capacity, FEF_{75%}=Expiratory Flow at 75% of exhaled vital capacity *statistically significant differences (U-Mann Whitney rank-sum test).

Multi-frequency respiratory system impedance (Z), resistance (R) and reactance (X) assessed with impulse oscillometry (Viasys Jaeger MasterScreen IOS system), and fractional exhaled nitric oxide (FENO, Eco Medics AG CLD 88 Series chemiluminescence analyzer) were measured in that sequence, before and immediately after 30 minutes of water-pipe smoking, or equal session in the smoking area, using the water-pipe without smoking (control group, blind control was impossible). Spirometry (Jaeger MasterScreen spirometry system) was performed at the end of the control session. Wilcoxon signed rank and U-Mann-Whitney rank sum tests were performed for the statistical analysis.

Results

Immediately after 30 minutes of water-pipe smoking Z5Hz, R5Hz, R10Hz and R20Hz were significantly increased (+10.1% to +12.61%, p≤0.001) both in the whole population (n=50) and each of the two subgroups. Among the two subgroups, significant difference at the changes of X20Hz was identified (-7.57% in MRS and +8.49% in NRS respectively, p=0.007). FENO was significantly reduced in the whole population (n=50, -4.78%, p=0.002) and the MRS-subgroup (-2.39%, p=0.003) but not in the NRS-subgroup (-8.73%, p=0.064). In the control group, no significant changes were detected.

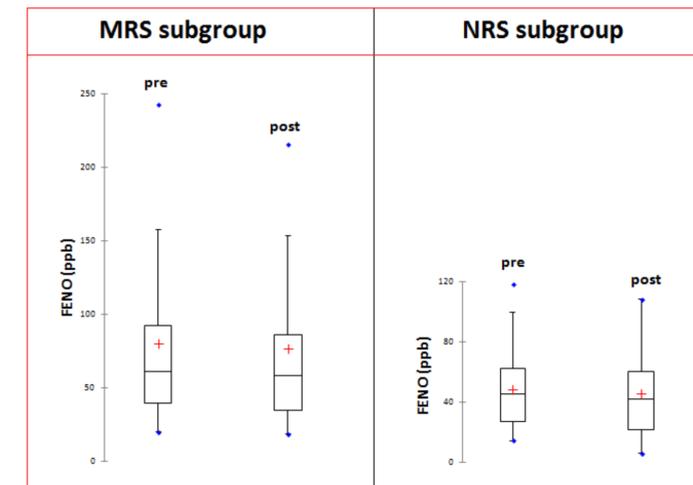


Figure 2: Fractional exhaled nitric oxide (FENO) levels before and immediately after 30 minutes of cigar smoking or control session, among young smokers with (MRS) and without (NRS) mild respiratory symptoms. + = mean value, - = median value, Abbreviations: ppb = parts per billion

Discussion

In this study, we investigated the immediate effects of WPS on lung function, among young regular cigarette and frequent water-pipe smokers, with and without mild respiratory complaints.

In both MRS and NRS subgroups, respiratory system impedance was significantly increased immediately after 30 minutes of WPS. This change was attributable to the significant increase of both peripheral (R5) and central (R20) airways resistance, since respiratory system compliance (reflected by X5 values) was not significantly modified. Additionally, FENO was significantly reduced immediately after 30 minutes of WPS in the whole population studied (n=50) confirming previously published data³, but the alteration was mainly attributable to the significant FENO reduction identified in the MRS subgroup, since in NRS subgroup, the above change was not significant. This indicates that mild respiratory symptoms combined with mild peripheral airways obstruction predispose to a more intense immediate response of the respiratory system to oxidative stress caused by WPS.

References

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