



ORIGINAL ARTICLE

Immediate and short term effects of smoking on nasal mucociliary clearance in smokers[☆]

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KEYWORDS

Mucociliary clearance;
Smoking;
Saccharin sodium

Abstract

Background and objectives: The efficiency of mucociliary transport may vary in different conditions, such as in exposure to harmful particles of the cigarette smoke. The present study evaluated the acute and short term effects of smoking on nasal mucociliary clearance in current smokers by the quantification of the Saccharin Transit Time (STT), and to investigate its correlation with the history of tobacco consumption.

Methods: Nineteen current smokers (11 men, 51 ± 16 years; BMI 23 ± 9 kg/m², 27 ± 11 cigarettes per day, 44 ± 25 pack-years), entering a smoking cessation intervention program, responded to a questionnaire concerning smoking history and were submitted to lung function assessment (spirometry) and the STT test. STT was assessed immediately after smoking and 8 hours after smoking. The STT test was also performed in nineteen matched healthy non-smokers' who served as control group.

Results: When compared to STT in non-smokers' (10 ± 4 min; mean ± standard deviation), smokers presented similar STT immediately after smoking (11 ± 6 min; p=0.87) and slower STT 8 hours after smoking (16 ± 6 min; p=0.005 versus non-smokers' and p=0.003 versus immediately after smoking). STT 8 hours after smoking correlated positively with age (r=0.59; p=0.007), cigarettes per day (r=0.53; p=0.02) and pack-years index (r=0.74; p=0.0003).

Conclusions: In smokers, although the mucociliary clearance immediately after smoking is similar to non-smokers', eight hours after smoking it is reduced, and this reduction is closely related to the smoking habits.

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PALAVRAS-CHAVE

Transporte mucociliar nasal;
Tabagismo;
Teste de trânsito de sacarina

Efeito imediato e a curto prazo do cigarro sobre o transporte mucociliar nasal de fumadores**Resumo**

Introdução e objetivo: A eficiência do transporte mucociliar pode variar em diferentes condições, como na exposição a partículas nocivas do fumo do cigarro. O presente estudo avaliou os efeitos do cigarro, tanto imediato quanto a curto prazo, no transporte mucociliar nasal de fumadores por meio da quantificação do tempo de trânsito da sacarina (TTS), e correlacionou-os com a intensidade de consumo tabágico.

Métodos: Dezanove fumadores ativos (11 homens; 51 ± 16 anos; $IMC 23 \pm 9 \text{ kg/m}^2$; 27 ± 11 cigarros/dia; 44 ± 25 anos/maço), participantes de programa de intervenção antitabagismo, responderam a um questionário referente a história tabágica e foram submetidos à avaliação da função pulmonar (espirometria) e transporte mucociliar (pelo TTS), este imediatamente e após 8 horas do acto de fumar. Para comparação, um grupo pareado composto por 19 indivíduos saudáveis não fumadores foi avaliado por meio dos mesmos testes.

Resultados: Quando comparados ao TTS de não fumadores (10 ± 4 min; média \pm desvio padrão), os fumadores apresentaram tempo de transporte similar imediatamente após fumar (11 ± 6 min; $p=0,87$) e significativamente mais lento 8 horas após fumar (16 ± 6 min; $p=0,005$ versus não fumadores e $p=0,003$ versus fumadores). Em fumadores, o TTS 8 horas após fumar correlacionou-se positivamente com a idade ($r=0,59$; $p=0,007$), o número de cigarros/dia ($r=0,53$; $p=0,02$) e o índice anos/maço ($r=0,74$; $p=0,0003$).

Conclusão: Embora indivíduos fumadores imediatamente após fumar apresentem transporte mucociliar similar ao de indivíduos não fumadores, 8 horas após o consumo tabágico o transporte mucociliar mostra-se reduzido e relacionado com os hábitos tabágicos.

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Introduction

Mucociliary transport is the main defense mechanism of the respiratory tract against pathogens and toxins, both in the upper and lower airways.^{1,2} However, it should be noted that the efficiency of transport may vary in different conditions, such as exposure to harmful particles of cigarette smoke.³

In vitro and in vivo studies have shown that exposure of the ciliated epithelium to particles of cigarette smoke results in a significant decrease in ciliary beat frequency.^{4,5} Cohen et al.⁶ showed that ciliary beats were diminished as a result of exposure to tobacco smoke, thus impairing mucociliary clearance. These results are in contrast to the findings of Stanley et al.,⁷ who did not find any difference in ciliary beat frequency between smokers and nonsmokers and reported a normal ciliary beat frequency. Nevertheless, they described that mucociliary transport was slower in regular smokers, and suggested that the exposure of nasal mucosa to cigarette smoke varies considerably depending on the type of cigarette and whether the smoke is exhaled by the nose or mouth.⁷ Others observed, moreover, that the mucus velocity in nonsmokers is faster than in ex-smokers.⁸

Therefore, generally speaking, differences in mucociliary transport between smokers and nonsmokers are common. However, despite these preliminary data, mucociliary transport has not been yet studied with the necessary depth. For example, neither the differences between acute and chronic responses of the mucociliary system to tobacco smoke exposure nor the association between mucociliary transport impairment and the individual's tobacco use history have been deeply investigated. Thus, the aim of this study was to evaluate the effects of smoking on mucociliary

clearance in smokers, immediately and eight hours after smoking, by quantifying the saccharin transit time (STT) and to investigate its correlation with the subject's history of tobacco consumption.

Methods**Participants**

Two groups of subjects were evaluated: 19 current smokers, classified in their majority as heavy smokers (smoking 20 or more cigarettes/day)⁹ who were entering an Anti-Tobacco Awareness Program, and 19 healthy matched nonsmokers (Table 1). Individuals with cystic fibrosis, bronchiectasis,

Table 1 Sample Characteristics of smokers and nonsmokers (Values are mean \pm SD).

	Smokers (n = 19)	Nonsmokers (n = 19)
Age (y)	51 \pm 16	47 \pm 11
Men/Women	11/8	10/9
Weight (Kg)	70 \pm 12	77 \pm 17
Height (cm)	165 \pm 11*	167 \pm 0,12
BMI (Kg/m ²)	23 \pm 9	27 \pm 4
Cigarettes per day	27 \pm 11	NA
Duration of smoking (y)	33 \pm 11	NA
Pack-years index	44 \pm 25	NA

NOTE. Abbreviations: BMI, body mass index; NA, not applicable.
* $P < 0.05$ vs healthy nonsmokers.

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