



ORIGINAL ARTICLE

Mucociliary clearance and its relation with the level of physical activity in daily life in healthy smokers and nonsmokers[☆]

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KEYWORDS

Mucociliary clearance;
Physical activity;
Smoking

Abstract

Objectives: To investigate the relationship between mucociliary transport and physical activity in daily life (PADL) in smokers and nonsmokers.

Methods: Fifty-two current smokers were submitted to an assessment of mucociliary transport (saccharin transit time, STT), carbon monoxide levels in the exhaled air, lung function and smoking history. In addition, subjects kept a pedometer worn at the waist for six days in order to determine their level of PADL (steps/day). The tests were also performed on 30 matched healthy nonsmokers who served as control group.

Results: Light smokers (≤ 15 cigarettes/day) had a STT of 9 (7–11) min (median [confidence interval]), which was similar to nonsmokers (8 [8–11] min; $p=0.8$). Both moderate (16–25 cigarettes/day) and heavy (>25 cigarettes/day) smokers had a significantly higher STT (13 [11–17] min and 13 [10–21] min, respectively) than nonsmokers and light smokers ($p<0.05$ for all). There was no difference in the number of steps/day between any of the groups ($p>0.05$ for all). In the general group of smokers, STT was not significantly correlated with PADL, pack/years index, years of smoking or age ($r<-0.23$; $p>0.09$ for all). There was significant negative correlation between STT and PADL only in light smokers ($r=-0.55$; $p=0.02$) and nonsmokers ($r=-0.42$; $p=0.02$), but not in moderate and heavy smokers.

Conclusion: In light smokers and non-smokers, better mucociliary function is associated to higher daily physical activity level, as opposed to the decreased mucociliary function observed in smokers, i.e., those with moderate and heavy cigarette consumption.

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PALAVRAS-CHAVE

Transporte mucociliar;
Atividade física;
Tabagismo

Transporte mucociliar e sua relação com o nível de atividade física na vida diária em fumantes saudáveis e não fumantes

Resumo

Objetivos: Investigar a relação entre o transporte mucociliar e a atividade física na vida diária (AFVD) em fumantes e não fumantes.

Métodos: Cinquenta e dois fumantes foram submetidos à avaliação do transporte mucociliar (Tempo de Trânsito de Sacarina, TTS), dos níveis de monóxido de carbono no ar expirado, da função pulmonar e do histórico tabagístico. Além disso, os sujeitos permaneceram por 6 dias com um pedômetro para determinar o seu nível de AFVD (passos/dia). Os testes também foram realizados em 30 indivíduos não fumantes saudáveis, pareados, que serviram como grupo controle.

Resultados: Os fumantes leves (≤ 15 cigarros/dia) apresentaram um TTS de 9 (7-11) minutos (mediana [intervalo de confiança]), que foi similar aos não-fumantes (8 [8-11] min; $p = 0,8$). Ambos os fumantes moderados (16-25 cigarros/dia) e severos (> 25 cigarros/dia) apresentaram TTS significativamente maior (13 [11-17] min e 13 [10-21] min, respetivamente) do que os não fumantes e fumantes leves ($p < 0,05$ para todos). No grupo de fumantes em geral, não houve correlação estatisticamente significativa entre o TTS e AFVD, índice anos/maço, anos de tabagismo e idade ($r < -0,23$; $p > 0,09$ para todos). Houve correlação negativa significativa entre o TTS e a AFVD apenas em fumantes leves ($r = -0,55$; $p = 0,02$) e não fumantes ($r = -0,42$; $p = 0,02$), mas não em fumantes moderados e pesados.

Conclusão: Em fumantes leves e não fumantes, uma melhor função mucociliar está associada a maiores níveis de atividade física diária, ao contrário dos fumantes com função mucociliar diminuída, ou seja, aqueles com consumo moderado e severo de cigarros.

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Introduction

Studies have shown that the effectiveness of mucociliary clearance is impaired in smokers compared to nonsmokers.^{1,2} It is also known that, in nonsmokers, regular physical activity when performed at moderate intensity improves the immune system response.³ However, the relationship between physical activity and mucociliary transport is not completely clear and has shown conflicting results. Wolff et al.⁴ observed a slight increase in mucociliary clearance after exercise, unlike Olseni and Wollmer⁵ who observed no substantial changes. Furthermore, these studies only described the acute (*i.e.*, transient) response of the mucociliary system to exercise, but the chronic adaptive response to regular daily physical activity remains unknown. In addition, these studies were performed only in nonsmokers, and to the authors' best knowledge, no studies involving this issue had yet been carried out in smokers.

Thus, the aim of this study was to describe the relationship between mucociliary transport and the level of physical activity in daily life (PADL) in healthy smokers (*i.e.*, with no lung function impairment) and healthy nonsmokers.

Materials and methods**Design and study subjects**

This cross-sectional observational study was undertaken with a convenience sample of 52 current smokers (Table 1)

assessed during intake process before starting a program with the aim of increasing their daily physical activity. They were volunteers and had learned about the project through advertisements in the media, buses and health centers. Inclusion criteria were: current smoking; normal lung function (according to internationally accepted criteria)⁶; and absence of history of cystic fibrosis, bronchiectasis, immotile cilia syndrome, nasal surgery or trauma and chronic and/or recent inflammation process in the upper airway which was established during an initial interview. Exclusion criterion was the presence of bone, nervous and/or muscle dysfunction which could interfere in the objective assessment of PADL. Subjects were included regardless of whether they intended to quit smoking in the future or not, and no subject quit or reduced smoking during the assessment period. No pharmacological treatment for smoking or any other reason was provided during the assessment period. For comparison, a group composed of 30 healthy nonsmokers (Table 1) was also assessed. This group was matched to the smoker groups by similar age, gender and body mass index.

For analysis purposes, smokers were divided into three groups according to the intensity of cigarette consumption: light smokers ($n = 17$), who smoked up to 15 cigarettes/day; moderate smokers ($n = 22$), 16–25 cigarettes/day, and heavy smokers ($n = 13$), more than 25 cigarettes/day (Table 1).⁷ All participants had been previously informed about the objectives and procedures of the study and, after signing the consent form, became part of the research. The study was approved by the institution's Committee of Ethics in Research (No. 007/07).

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