



# Smoking status and its relationship with exercise capacity, physical activity in daily life and quality of life in physically independent, elderly individuals

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## Abstract

**Objective** To investigate the relationship between smoking status and exercise capacity, physical activity in daily life and health-related quality of life in physically independent, elderly ( $\geq 60$  years) individuals.

**Design** Cross-sectional, observational study.

**Setting** Community-dwelling, elderly individuals.

**Participants** One hundred and fifty-four elderly individuals were categorised into four groups according to their smoking status: never smokers ( $n = 57$ ), passive smokers ( $n = 30$ ), ex-smokers ( $n = 45$ ) and current smokers ( $n = 22$ ).

**Main outcome measures** Exercise capacity [6-minute walk test (6MWT)], physical activity in daily life (step counting) and health-related quality of life [36-Item Short Form Health Survey (SF-36) questionnaire] were assessed.

**Results** Current and ex-smokers had lower mean exercise capacity compared with never smokers: 90 [standard deviation (SD) 10] % predicted, 91 (SD 12) % predicted and 100 (SD 13) % predicted distance on 6MWT, respectively [mean differences  $-9.8\%$ , 95% confidence intervals (CI)  $-17.8$  to  $-1.8$  and  $-9.1\%$ , 95% CI  $-15.4$  to  $-2.7$ , respectively;  $P < 0.05$  for both]. The level of physical activity did not differ between the groups, but was found to correlate negatively with the level of nicotine dependence in current smokers ( $r = -0.47$ ,  $P = 0.03$ ). The median score for the mental health dimension of SF-36 was worse in passive {72 [interquartile range (IQR) 56 to 96] points} and current [76 (IQR 55 to 80) points] smokers compared with ex-smokers [88 (IQR 70 to 100) points] (median differences  $-16$  points, 95% CI  $-22.2$  to  $-3.0$  and  $-12$  points, 95% CI  $-22.8$  to  $-2.4$ , respectively;  $P < 0.05$  for both).

**Conclusions** Among elderly individuals, current smokers had lower exercise capacity than never smokers. Although the level of physical activity did not differ between the groups, an association was found with smoking. Tobacco exposure was associated with worse scores for the mental health dimension of SF-36 in physically independent, elderly individuals.

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## Introduction

Smoking contributes to the development of cancer and several respiratory diseases [1], and leads to nearly six million deaths per year [2]. The prevalence of smoking in

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developing countries, such as Brazil, is approximately 16% in the adult population [3], which is relatively low compared with the situation in Europe (approximately 29%) [1], but still important. Smoking is the main cause of chronic obstructive pulmonary disease (COPD), and has been associated with rapid decline in lung function, higher airway responsiveness and higher risk of exacerbations in this population [1,4]. However, the effects of smoking in healthy subjects have received less research attention.

Furlanetto *et al.* found that middle-aged smokers without airflow limitation undertake less walking in daily life and have lower exercise capacity compared with matched non-smokers [5]. Pitsavos *et al.* found that physically active subjects were more likely to be non-smokers than physically inactive subjects [6]. A negative relationship between smoking and health-related quality of life has been shown in several studies [7–9].

Muscular alterations such as fibre atrophy and increased glycolytic capacity have been reported in smokers with no pulmonary alterations [10]. Faster deterioration in body composition [11] and higher levels of anxiety and depression [12] have also been reported. These factors, in isolation or in combination, may compromise exercise capacity and physical activity in daily life of healthy smokers, as well as quality of life.

Irrespective of smoking status, decreased exercise capacity, lower levels of physical activity in daily life and impaired quality of life are observed in elderly individuals as a consequence of ageing [13,14]. It was hypothesised that these deleterious effects may be enhanced as a consequence of smoking in elderly individuals. Nevertheless, studies addressing this issue are lacking in the literature. Therefore, this study aimed to investigate the relationship between smoking status and exercise capacity, physical activity in daily life and health-related quality of life in physically independent elderly individuals.

## Methods

### *Study design and participants*

This cross-sectional study used data from two research projects developed in Londrina, Brazil: the Study on Ageing and Longevity (EELO), an interdisciplinary thematic project developed at Universidade Norte do Paraná (UNOPAR) that aimed to evaluate sociodemographic factors and indicators of health conditions of elderly individuals in Londrina, Brazil (<http://www2.unopar.br/eelo/index.html>); and the Study to Promote Physical Activity in Smokers (EPAFT), a randomised, crossover trial developed at Universidade Estadual de Londrina (UEL) that aimed to analyse the effects of two different motivational strategies to increase physical activity in daily life in smokers [5,15–17]. Only the baseline results were used. The period of data collection was from July 2008 to July 2011. The study coordinators of EELO and EPAFT provided consent for use of data.

The inclusion criteria for the present study were: age  $\geq 60$  years; functional status compatible with physical independence (i.e. Levels 3 and 4 according to Spirduso [18]); absence of diseases or conditions that could limit the assessments proposed; absence of lung function abnormalities; and complete data.

### *Assessments*

Demographics, anthropometrics, clinical data, smoking status, exercise capacity, physical activity in daily life and health-related quality of life were assessed. Details are given below.

#### *Demographic, anthropometric and clinical data*

A standardised questionnaire was used to collect data on age, gender, presence of comorbidities, current work and/or regular physical activity, weight, height, body mass index and smoking habit in the current and ex-smoker groups. Subjects underwent spirometry (Pony FX, Cosmed, Italy) [19,20] to rule out those with lung function abnormalities.

#### *Smoking status*

The definitions used by Freitas *et al.* were adopted to classify subjects as current, ex-, passive or never smokers [21]. Current smokers were defined as subjects who, at the time of data collection, had been smoking any type and/or quantity of tobacco on a daily basis for at least 6 months. Ex-smokers were defined as those who were smokers, but had not smoked for at least the previous 6 months at the time of data collection. Never smokers were defined as those who had never smoked, smoked for less than 6 months or smoked sporadically. Passive smokers were defined as those who had never smoked, but had been living with a smoker for at least the previous 6 months at the time of data collection. The level of nicotine dependence was assessed in current and ex-smokers [22].

#### *Exercise capacity*

The 6-minute walk test (6MWT) was used, in accordance with the protocol of the American Thoracic Society [23] and the reference values of Troosters *et al.* [24]. Two tests were performed, as good reliability has been reported after two tests [23], and the test with the longest walk distance was considered for analysis. Immediately before and after each test, heart rate, blood pressure, dyspnoea and fatigue were assessed. The predicted maximal heart rate was calculated using Karvonen's formula ( $220 - \text{age}$ ).

#### *Physical activity in daily life*

The number of steps per day, counted using the Yamax Digi-Walker – SW700 pedometer (Yamassa Corporation, Tokyo, Japan), was used to assess the level of physical activity in daily life. This pedometer has been shown to be valid and reliable [25]. Subjects were instructed to wear the device on the right side of the waist, putting it on when they woke up

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