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Cross-Sectional Study

The impact of physical activity level, degree of dyspnoea and pulmonary function on the performance of healthy young adults during exercise

Vívian Pinto Almeida [a], Arthur Sá Ferreira [a], Fernando Silva Guimarães [a], Jannis Papathanasiou [b, c], Agnaldo José Lopes [a, d, *]

[a] Rehabilitation Sciences Post-graduate Programme, Augusto Motta University Centre (UNISUAM), Rio de Janeiro, Brazil
[b] Department of Medical Imaging, Allergology and Physiotherapy, Faculty of Dental Medicine, Medical University of Plovdiv, Bulgaria
[c] Department of Kinesitherapy, Faculty of Public Health, Medical University of Sofia, Bulgaria
[d] Post-graduate Programme in Medical Sciences, School of Medical Sciences, State University of Rio de Janeiro (UERJ), Rio de Janeiro, Brazil

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ABSTRACT

Background: In addition to being simple and requiring minimal technology, the 6-min walk test (6MWT) has been found to be reproducible and well tolerated since its first use. However, the impact of non-anthropometric factors on functional capacity is less clear in healthy young adults because the majority experience no age-related changes in the locomotor system or associated comorbidities.
Aim: To identify the effect of physical activity level, degree of dyspnoea and pulmonary function on functional capacity, evaluated through the 6-min walking distance (6MWD) of healthy young adults, in order to prevent clinical abnormalities.
Method: This is a cross-sectional study including 190 healthy young adults who were subjected to the 6MWT to assess walking distance and degree of dyspnoea using the Borg scale. Furthermore, pulmonary function using spirometry and physical activity level using the International Physical Activity Questionnaire (IPAQ) were assessed. According to the IPAQ, the subjects were categorised as sedentary, irregularly active or active.
Results: The 6MWD was positively correlated with pulmonary function parameters ($P \leq 0.002$ for all parameters). There was a marginally significant correlation between the 6MWD and the difference between the scores assessed before and after the test using the Borg scale. There was a trend towards significant differences in 6MWD according to the IPAQ categories. Furthermore, forced vital capacity was the only pulmonary function parameter with significant differences between IPAQ categories ($P = 0.02$).
Conclusion: In healthy young adults, greater pulmonary function indicates a greater 6MWD. In these subjects, physical activity level based on the IPAQ categories clearly affects pulmonary function. However, the IPAQ category and degree of dyspnoea are poorly related to the 6MWD of these subjects.

1. Introduction

The act of walking is considered one of the five main activities of daily living (ADLs), along with the acts of breathing, hearing, seeing and speaking (Ambrosino, 1999). Accordingly, functional walking tests have been proposed to measure the functional capacity of individuals with various health conditions. The 6-min walk test (6MWT) is used to evaluate the response of an individual to exercise and provides a general analysis of the respiratory, cardiac and metabolic systems (ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories, 2002). It assesses the distance a person is able to travel on a flat, rigid surface in 6 min and primarily aims to determine exercise tolerance during a submaximal exercise. The 6MWT has been used worldwide as a predictor of mortality in various conditions, including heart failure, chronic obstructive pulmonary disease (COPD) and pulmonary hypertension (Reibis et al., 2010; Golpe et al., 2013). The variability in the 6-

* Corresponding author. Rehabilitation Sciences Post-graduate Programme, Augusto Motta University Centre (UNISUAM), Praça das Nações, 34, Bonsucesso, 21041-010, Rio de Janeiro, Brazil.
E-mail address: agnaldolopes.uerj@gmail.com (A.J. Lopes).

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min walking distance (6MWD) has been explained, at least partly, by gender, age, height and weight differences (Morales-Blanhir et al., 2011). However, predictive equations have, at best, coefficients of determination of 0.4, which means that 60% of the 6MWD variability amongst healthy individuals remains undetermined (Neder, 2011).

Several studies have shown the efficacy of regular physical activity in preventing chronic diseases, such as cardiovascular diseases, obesity, diabetes, cancer and osteoporosis. It has been suggested that the level of physical activity and health status are significantly associated; thus, increased physical fitness may result in additional health benefits (Warburton et al., 2006). In some clinical conditions, the 6MWD is correlated with performance in ADLs because functional capacity is closely linked with the energy expenditure required for physical activities and an increased ADL ability (Westerterp, 2013). In patients with COPD, for example, a higher 6MWD has been associated with a greater level of physical activity in daily life (Hernandes et al., 2009). Thus, the interest in assessing the effects of a sedentary lifestyle has been increasing due to its association with risk factors such as low aerobic capacity and peripheral vascular endothelial dysfunction (Riess et al., 2006).

Dyspnoea, which is usually described by patients as "shortness of breath", is a common, albeit unspecific, symptom and is associated with exercise performance and, therefore, with health-related quality of life (HRQoL). Population-based studies suggest a 9–35% prevalence of unexplained exertional dyspnoea amongst community-residing adults (Parshall et al., 2012; Huang et al., 2017). Measuring dyspnoea provides an independent dimension not given by pulmonary function tests (PFTs). Therefore, assessing dyspnoea affects and predicts HRQoL and survival more broadly than physiological measures (Camargo and Pereira, 2010). In recent years, numerous studies have suggested that the sensation of dyspnoea does not involve a single perception but rather a set of diverse sensations (Parshall et al., 2012; Mendonca et al., 2014). Despite these advances in the understanding of mechanisms involved in dyspnoea, little is known about the variability of the perception of dyspnoea amongst healthy individuals, whether at rest or under effort (Ziegler et al., 2015).

The association between pulmonary function and exercise performance has been previously studied in several clinical conditions, showing contradictory results between groups of patients with different diseases and even between different groups of patients with the same disease (Rodrigues and Viegas, 2002; Pimenta et al., 2010; Ho et al., 2015). The hypothesis that 6MWT contributes to the classical assessment of pulmonary function and is thus able to provide a more complete profile of the functional capacity of healthy individuals has been previously postulated (Zenteno et al., 2007). However, to our knowledge, the relationship between pulmonary function and 6MWD has been examined only in patients and elderly people, indicating a gap in this type of assessment in healthy young individuals.

In recent years, exercise tests have been recognised as a convenient tool to determine the functional capacity dynamically because the reserves of the various body systems must be known to assess in greater detail the functional capacity of individuals. In addition to anthropometric and demographic data, differences in functional status may be statistically significant and yet lower than the threshold at which individuals notice a difference between their performance and that of others (Redelmeier et al.,1997). Thus, the objective of the present study was to identify the effect of physical activity level, degree of dyspnoea and pulmonary function on functional capacity, evaluated through the 6MWD of healthy young adults, in order to prevent clinical abnormalities.

2. Methods

2.1. Subjects

Between March 2016 and August 2017, a cross-sectional study was conducted in which we evaluated 224 healthy subjects with a mean age of 29.4 ± 8.77 years. Some were recruited amongst the employees of the Federal University of the State of Rio de Janeiro (UNIRIO), in the city of Rio de Janeiro, Brazil, and others were recruited amongst the residents of the surrounding community. All subjects selected for the study were healthy and able to walk, requiring no type of walking aid. The following exclusion criteria were used: report of respiratory or cold symptoms in the last three weeks; history of cardiorespiratory, metabolic, osteoarticular or neuromuscular disease; history of thoracic surgery; having smoked more than 10 packs per year; and taking medications that could affect muscle function, such as statins. We also excluded subjects with a body mass index (BMI) lower than 18 kg/m^2 or higher than 40 kg/m^2 (Britto et al., 2013) as well as those considered 'very active' by the International Physical Activity Questionnaire (IPAQ) (Matsudo et al., 2001). The entire protocol followed the guidelines for research on human subjects in accordance with the Declaration of Helsinki. All participants signed the informed consent form previously approved by the Research Ethics Committee of the Augusto Motta University Centre (UNISUAM) under number CAAE-52689716.5.0000.5235.

2.2. Measurements

Weight and height were measured using standard techniques, and the subjects were barefoot and wearing light clothing. Weight was measured to the nearest 0.1 kg on a calibrated scale, and height was measured to the nearest 0.1 cm using a stadiometer. BMI was calculated as the weight in kilograms divided by the height in square metres (kg/m^2).

The physical activity level in ADLs was evaluated using the IPAQ, which assesses total energy expenditure expressed as metabolic equivalent tasks (METs) and the time spent in daily activities. These activities are divided into different intensities (vigorous, moderate and light) and expressed as METs/min/week for the following four domains: work, transportation, domestic activities and recreation and leisure. The results from all items are summed to calculate the total physical activity score (Craig et al., 2003). We used the IPAQ short version, which had been previously translated into and validated for Portuguese (Matsudo et al., 2001). The subjects were instructed to answer the questions based on the previous week. Afterwards, they were categorised into the following four groups, according to the IPAQ score: sedentary, irregularly active, active, or very active (Matsudo et al., 2001).

Pulmonary function was assessed by spirometry, which was performed on the same day as the 6MWT, using a Pony FX spirometer (Cosmed Ltd., Italy) after a 10-min break. Spirometry followed the standardisation and interpretation established by the American Thoracic Society (Miller et al., 2005). In this study, we evaluated the following parameters provided by spirometry: forced vital capacity (FVC), forced expiratory volume in 1 s (FEV_1) and peak expiratory flow (PEF). The highest values of at least three reproducible measurements of FEV_1 and of FVC were used, accepting a range of up to 150 mL or less than 5%. National equations were adopted to calculate the predicted values for each participant (Pereira et al., 2007).

Functional capacity was assessed through the 6MWT, which was performed in duplicate with at least 30 min rest between tests, and the subjects were previously familiarised with the procedure. The tests were performed in a flat, 30-m, outdoor corridor marked every 3 m and completely free of passers-by. The walking course was marked with orange traffic cones (see Fig. 1). The 6MWTs followed the step-by-step approach previously recommended by the American Thoracic Society (ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories, 2002).

The modified Borg Dyspnoea Scale was applied at baseline and at minute six of the 6MWT. The scale ranges from zero to 10 points, in which zero is the absence of dyspnoea and 10 is the worst sensation of dyspnoea, and was used to classify the fatigue and exhaustion levels of the participants (Borg Rating of Perceived Exertion—RPE), as shown in Table 1 (ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories, 2002). The Borg RPE is a way of measuring the intensity of any physical activity; it is based on the physical sensations a person experiences during physical activity, including increased heart rate, increased breathing rate, increased sweating and muscle fatigue (Borg, 1982). For a better understanding of this scale, prior to the 6MWT, the participants were familiarised with the Borg RPE concept to allow them to get used to answering in an adequate manner when they were asked about the intensity of the exercise. Subsequently, the difference in Borg scale between the scores assessed at baseline and at minute six of the 6MWT [(Δ Borg scale (0′–6′)] was then calculated. The 6MWT data collected in the test with the longest distance were included in the final analysis. The values provided by the Brazilian equations proposed by Britto et al. (2013) were used as a reference for the 6MWD.

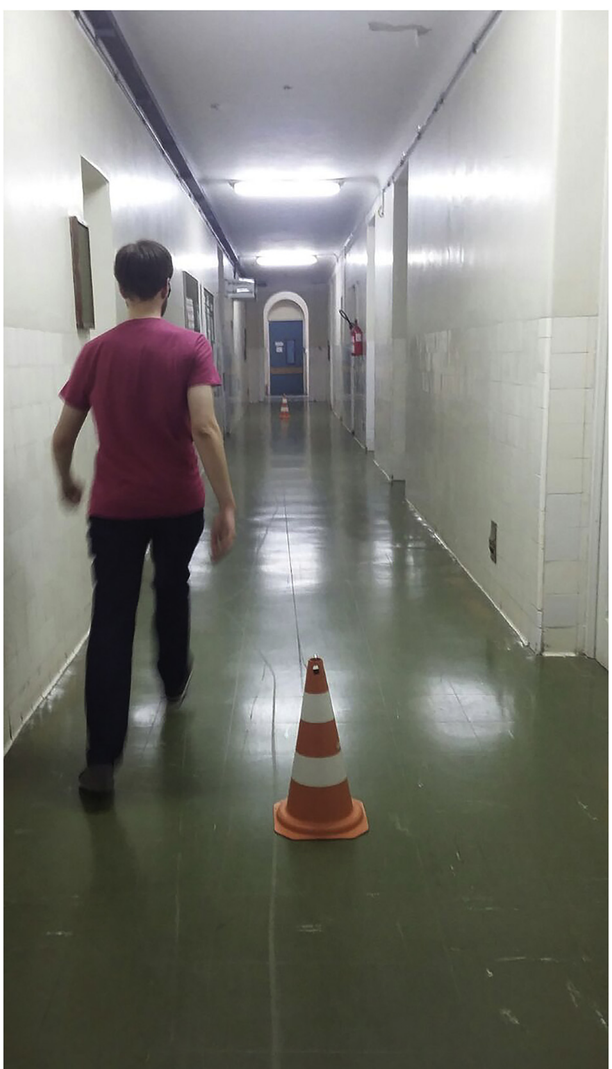

Fig. 1. Illustration of the 6-min walk test performed by a healthy young adult.

Table 1
The modified Borg Dyspnoea Scale and Borg Rating of Perceived Exertion.[a]

Level of dyspnoea	Level of fatigue
0	Nothing at all
0.5	Very, very slight (just noticeable)
1	Very slight
2	Slight (light)
3	Moderate
4	Somewhat severe
5	Severe (heavy)
6	
7	Very severe
8	
9	
10	Very, very severe (maximal)

[a] Adapted from the American Thoracic Society Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories, 2002.

2.3. Data analysis

Data were analysed using the software SPSS 17.0 (IBM Institute, Cary, NC, USA). Because the sample followed a Gaussian distribution according to the Shapiro-Wilk test, the results were expressed as the mean ± SD or as frequency (percentages). Because the equations proposed by Britto et al. (2013) have two explanatory models – one that includes the BMI and another that includes the difference in heart rate (HR) before and after the 6MWT (Δ HR) – we chose to use both models in the data interpretation as follows: 6MWD (% predicted BMI) and 6MWD (% predicted Δ HR). The Pearson correlation coefficient (r) was used to evaluate the association between the demographic variables, clinical data, pulmonary function and functional capacity. The comparisons between clinical data, pulmonary function and the 6MWT according to the IPAQ physical activity categories (IPAQ) were analysed using ANOVA followed by the Bonferroni post-hoc test. Statistical significance was set at $P < 0.05$.

3. Results

Of the 224 subjects eligible for evaluation, 34 were excluded from the study (see Fig. 2). Thus, the sample included 190 healthy subjects, with a mean age of 29.4 ± 8.77 years. Regarding the physical activity level, 28.9% were classified as sedentary according to the IPAQ, 36.3% were irregularly active, and 34.7% were active. Demographic and clinical data, pulmonary function parameters and 6MWT variables are outlined in Table 2.

Of the 190 subjects, 58% reported grade 0 (“nothing at all”), 27% reported grade 0.5 (“very, very slight”), 9% reported grade 1 (“very slight”) and 6% reported grade 2 (“slight”) at rest on the modified Borg Dyspnoea Scale (Borg RPE). At the end of the 6MWT, 44% of subjects reported grades <3, while 56% described grades ≥3; however, no one had a score ≥7 (that is, “very severe").

The correlations between the 6MWD measurements with demographic and anthropometric data and pulmonary function parameters are outlined in Table 3 and Fig. 3. The 6MWD (metres) was significantly correlated with all pulmonary function parameters. The 6MWD (% predicted BMI) was weakly correlated with FVC (L) and PEF (L/s). Lastly, the 6MWD (% predicted Δ HR) was significantly correlated with most pulmonary function parameters assessed. Furthermore, the correlation among the three forms of

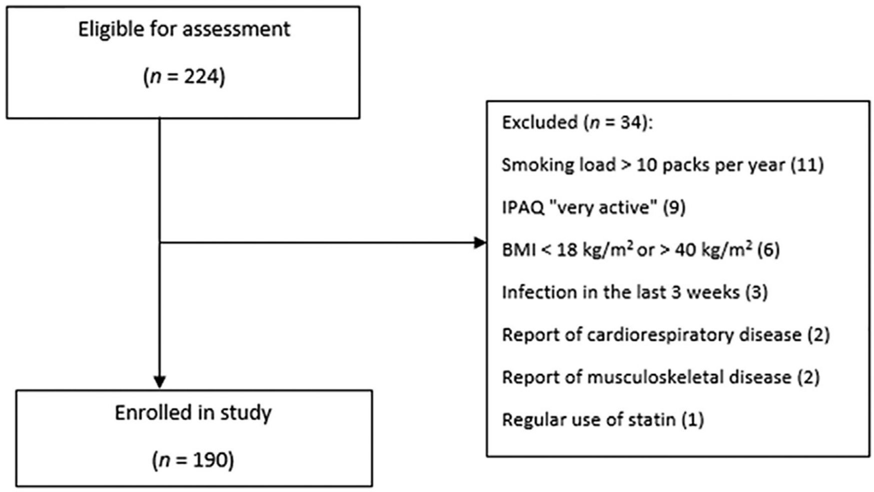

Fig. 2. Flow chart showing stages of the recruitment process.

Table 2
Participant demographics and anthropometric data, physical activity level, parameters of pulmonary function and variables of the 6-min walk test ($n = 190$).

Variable	Value
Demographic and anthropometric data	
Sex (% male)	50 (26.3)
Age (years)	29.4 ± 8.77
Body mass (kg)	68.1 ± 14.1
Body height (cm)	167 ± 8.52
BMI (kg/m^2)	24.3 ± 3.88
Physical activity level (IPAQ categories)	
Sedentary	55 (28.9)
Irregularly active	69 (36.3)
Active	66 (34.7)
Pulmonary function (spirometry)	
FEV$_1$ (L)	3.24 ± 0.70
FEV$_1$ (% predicted)	100.9 ± 14.9
FVC (L)	3.76 ± 0.88
FVC (% predicted)	106.1 ± 16.9
PEF (L/s)	7.23 ± 2.14
PEF (% predicted)	109.7 ± 23.6
Functional capacity (6MWT)	
6MWD (meters)	674.9 ± 81.2
6MWD (% predicted BMI)	105.7 ± 11.5
6MWD (% predicted Δ HR)	96.5 ± 5.64
Δ Borg scale (0′–6′)	3.78 ± 1.81
Δ HR (bpm)	34 ± 22.7

Results expressed as mean ± SD or number (%). BMI, body mass index; IPAQ, International Physical Activity Questionnaire; FEV$_1$, forced expiratory volume in 1 s; FVC, forced vital capacity; PEF, peak expiratory flow; 6MWT, 6-min walk test; 6MWD, 6-min walking distance; HR, heart rate.

Table 3
Pearson's correlation coefficients for demographic and anthropometric data, pulmonary function and functional capacity.

Variables	6MWD (meters)		6MWD (% predicted BMI)		6MWD (% predicted Δ HR)	
	r	*P*-value	*r*	*P*-value	*r*	*P*-value
Age (years)	−0.28	0.001	−0.21	0.004	−0.27	0.001
BMI (kg/m^2)	−0.16	0.03	−0.55	0.001	0.04	0.57
FEV$_1$ (L)	0.42	0.001	0.13	0.07	−0.26	0.001
FEV$_1$ (% predicted)	0.20	0.005	−0.06	0.37	0.17	0.02
FVC (L)	0.38	0.001	0.14	0.04	−0.30	0.001
FVC (% predicted)	0.22	0.002	−0.05	0.46	0.11	0.13
PEF (L/s)	0.38	0.001	0.15	0.04	−0.20	0.005
PEF (% predicted)	0.21	0.004	−0.07	0.62	0.17	0.02
Δ Borg scale (0′–6′)	0.12	0.06	0.13	0.07	−0.13	0.07
Δ HR (bpm)	0.07	0.33	0.02	0.73	−0.67	0.001

6MWD, 6-min walking distance; BMI, body mass index; HR, heart rate; FEV$_1$, forced expiratory volume in 1 s; FVC, forced vital capacity; PEF, peak expiratory flow.

the 6MWD assessed and the Δ Borg scale (0–6') was marginally significant.

We also compared the clinical data, pulmonary function and 6MWTs according to the three IPAQ categories assessed (see Table 4). The results showed a trend towards significant differences between mean 6MWD values (metres) according to the IPAQ categories. The FVC was the only pulmonary function parameter with significant differences between IPAQ categories (see Fig. 4).

4. Discussion

The main finding of the present study was that in healthy young adults, pulmonary function significantly affects the distance walked in the 6MWT. In these individuals, the degree of dyspnoea and the physical activity level according to the IPAQ categories only marginally affected the 6MWD. Furthermore, a higher IPAQ category resulted in a higher FVC value. To our knowledge, this is the

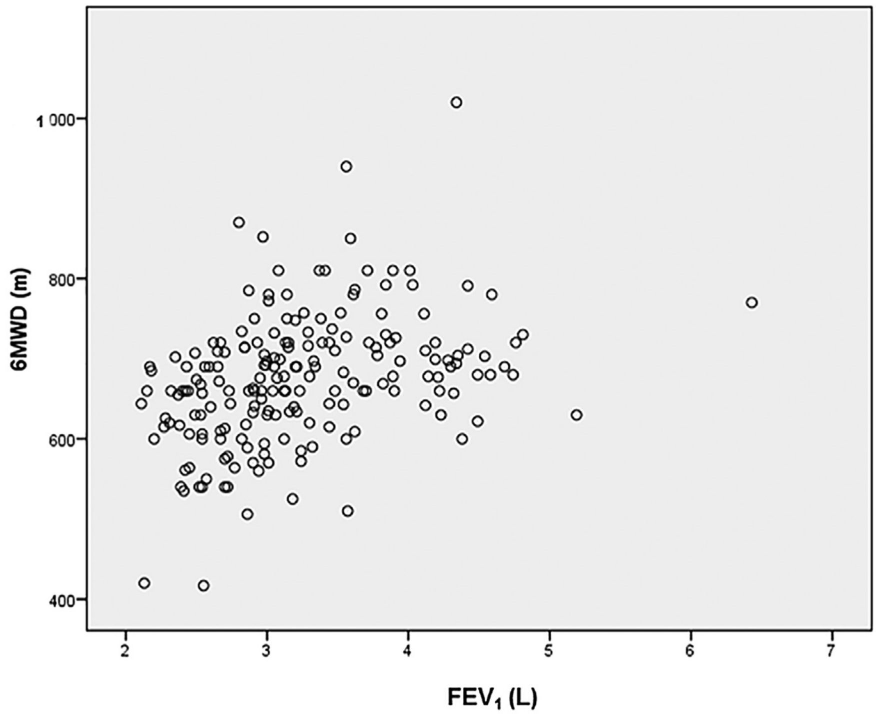

Fig. 3. Relationship of the 6-min walking distance (6MWD) with forced expiratory volume in 1 s (FEV_1) ($r = 0.42$, $P = 0.001$).

Table 4
Comparison of clinical data, pulmonary function and 6-min walking distance according to the International Physical Activity Questionnaire.

Variables	Sedentary (Group 1) ($n = 55$)	Irregularly active (Group 2) ($n = 69$)	Active (Group 3) ($n = 66$)	Between-groups ANOVA
Age (years)	29.3 ± 8.81	29.9 ± 9.24	29.1 ± 8.34	0.86
BMI (kg/m^2)	23.8 ± 4.43	24.3 ± 3.65	24.7 ± 3.63	0.42
FEV_1 (L)	3.09 ± 0.68	3.26 ± 0.74	3.36 ± 0.66	0.10
FEV_1 (% predicted)	98.8 ± 15.7	101.5 ± 15.1	101.9 ± 14.2	0.49
FVC (L)	3.51 ± 0.76	3.78 ± 0.88	3.94 ± 0.93	0.02/1-2-3
FVC (% predicted)	103.6 ± 17.5	107.4 ± 16.7	106.8 ± 16.6	0.42
PEF (L/s)	6.81 ± 2.12	7.25 ± 2.17	7.57 ± 2.11	0.57
PEF (% predicted)	105.6 ± 25.7	109.7 ± 22.1	113.2 ± 23.1	0.21
6MWD (meters)	663 ± 78.5	666.7 ± 73.3	693.3 ± 88.9	0.06
6MWD (% predicted BMI)	103.7 ± 10.6	105.1 ± 11.5	108.1 ± 11.9	0.09
6MWD (% predicted Δ HR)	96.8 ± 5.51	96.2 ± 5.64	96.5 ± 5.82	0.85
Δ Borg scale (0′–6′)	4.07 ± 1.81	3.86 ± 1.84	3.45 ± 1.76	0.18
Δ HR (bpm)	36.3 ± 21.07	34.7 ± 22.2	31.3 ± 24.6	0.16

Results expressed as mean ± SD. BMI, body mass index; FEV_1, forced expiratory volume in 1 s; FVC, forced vital capacity; PEF, peak expiratory flow; 6MWD, 6-min walking distance; HR, heart rate. Comparisons of the three groups/comparisons between adjacent groups: dashes indicate a significant difference.

first study assessing the impact of various factors on functional capacity in a robust sample of healthy young adults.

Understanding the mechanisms responsible for decreased functional capacity is based on data collected using maximal exercise tests. However, ADLs require submaximal effort (Morales-Blanhir et al., 2011). Thus, a test involving the dislocation of the entire body mass in ADLs common to most subjects has been sought for many years (Neder, 2011), which shows the importance of the initial description and increasing understanding of the 6MWT. More recently, a multi-centre study showed that predictive equations ranged considerably between centres (adjusted $r^2 = 0.09–0.73$) and explained < 30% of the 6MWD variance in four of the ten centres assessed (Casanova et al., 2011). In fact, the coefficient of determination (r^2) values of the 6MWD provided by anthropometric variables ranged from 0.25 to 0.42 in different studies (Soares and Pereira, 2011). Taken together, these findings clearly show the need for identifying new factors that may affect the 6MWD in healthy subjects (Casanova et al., 2011). In a population of healthy young adults, the impact of factors unrelated to anthropometric data on the 6MWD is less clear because the majority of this population do not typically experience age-related changes in the osteoarticular and neuromuscular systems or associated comorbidities. Indeed, Bautmans et al. (2004) showed significant decreases in the physical capacity of elderly people using individual parameters, including medical history, use of medicines and health status. This at least partly explains the low correlation values between the 6MWD and clinical and functional data collected in the present study.

Respiratory discomfort may arise from a wide range of clinical conditions. This discomfort primarily occurs as a result of either cardiovascular or respiratory system compromise but may also be attributed to upper airway obstruction, metabolic derangements, neuromuscular disorders or psychogenic conditions including anxiety (Zoorob and Campbell, 2003; Coccia et al., 2016). Almost

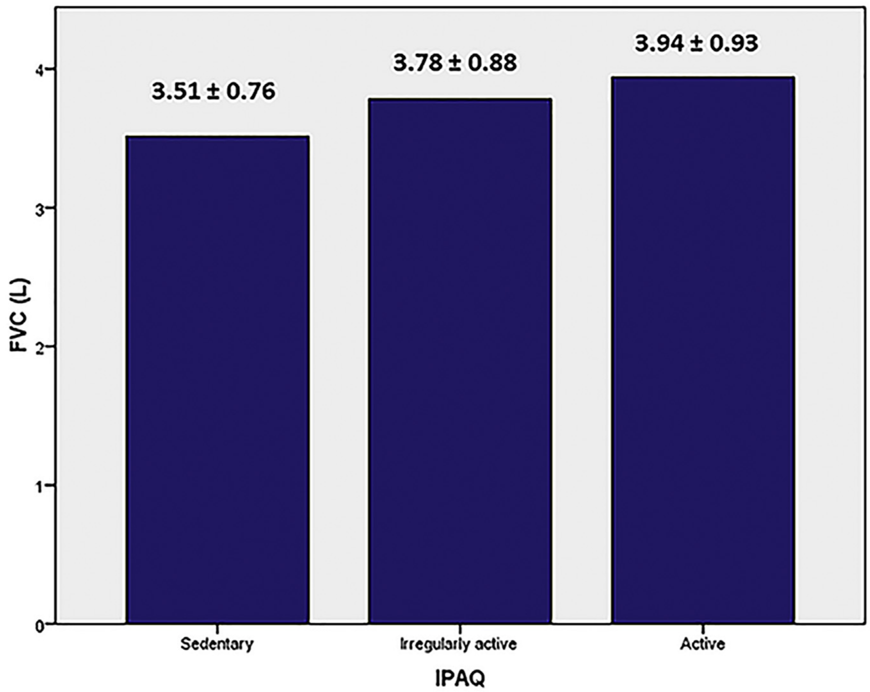

Fig. 4. Values (mean ± SD) for forced vital capacity (FVC) according to the International Physical Activity Questionnaire (IPAQ) categories. A significant difference ($P = 0.02$) was found between the three groups.

90% of all cases of dyspnoea are due to asthma, heart failure, myocardial ischaemia, COPD, pneumonia or psychogenic disorders (Zoorob and Campbell, 2003). However, dyspnoea has also been highlighted as a manifestation of low cardiovascular fitness in an increasingly sedentary world population (Parshall et al., 2012). This can apply to those who are deconditioned due to physical inactivity for a variety of reasons, including obesity (Lorenzo and Babb, 2012). Nevertheless, we did not identify a significant relationship between the degree of dyspnoea and the level of physical activity in the ADLs assessed using the IPAQ. Additionally, we observed that the 6MWD was only marginally associated with the IPAQ categories. Similar to our findings, Soares and Pereira (2011) observed, in a sample of 132 healthy volunteers, that habitual physical activity assessed using the Baecke questionnaire was marginally correlated with 6MWD in the univariate analysis ($r = 0.23$; $P = 0.07$), which was not confirmed in the multivariate analysis. More recently, Zou et al. (2017) observed a significant difference in the distance travelled between physically active and sedentary individuals. The differences in the results from these three studies may be partly explained by the fact that Zou et al. (2017) did not exclude subjects classified as 'very active', which increased the sample heterogeneity in terms of the level of physical fitness to some extent. A more active lifestyle usually changes muscle metabolism, muscle mass and physical fitness. This results in adaptations of the cardiorespiratory and neuromuscular systems and improves the oxygen supply to the mitochondria, which partly explains the reason why the 6MWD travelled by the most active subjects is significantly higher than the 6MWD travelled by the sedentary subjects (Jones and Carter, 2000; Cheng et al., 2003). Importantly, the use of faulty reference equations for field walking tests in healthy adults may result in errors related to the interpretation of the fitness level and the improvement in distance covered after interventions in patients with chronic diseases (Dourado et al., 2011).

Dyspnoea is a complex symptom that may signal a critical threat to homeostasis and consequently often leads to adaptive responses, decreased functional performance and impaired HRQoL (Parshall et al., 2012). In our study, we observed a trend towards a significant association only between the level of sensation of exertional dyspnoea according to the modified Borg Dyspnoea Scale and the 6MWD assessed using both the % predicted BMI and the % predicted Δ HR. Consistent with our findings, Zou et al. (2017) observed no clinically significant differences between Borg scores before and after the test. These weak correlations may be explained, at least partly, by the multidimensional aspects of dyspnoea and by differences between the sensory and emotional aspects of its perception. Curiously, Soares and Pereira (2011) observed that the modified Borg Dyspnoea Scale increased up to four points during the 6MWT in healthy subjects; however, that study did not evaluate the association between changes in the Borg scale and the 6MWD. The sensation of dyspnoea has several aspects that involve physiological, psychological, social and environmental factors, which result in a variable behavioural response (Parshall et al., 2012; Mendonca et al., 2014).

PFTs provide quantitative and reproducible results, allowing longitudinal evaluations and the prediction of morbidity and mortality (Miller et al., 2005). In our study, pulmonary function was significantly associated with the 6MWD. Thus, the ventilatory response seems to play a role in limiting the submaximal exercise capacity of healthy individuals. The results suggest that during exercise, individuals reach the maximum limit of the lung-chest system to promote the ventilation required for homeostasis of the external response. However, in maximal exercise tests with individuals without respiratory diseases, exercise limitation has been associated with the performance of the cardiovascular and peripheral systems, not with pulmonary function (Jones and Killian, 2000). Another finding that stands out in our study is the effect of IPA categorisation on pulmonary function, particularly on FVC. In contrast to our findings, Barboza et al. (2016) observed that physical inactivity assessed using the IPAQ and by triaxial accelerometry showed a somewhat inconsistent association with pulmonary function amongst smokers. However, longitudinal studies have shown that after the maximal growth phase, FVC remains unchanged until the beginning of the third decade of life, and the lack of FVC decline may reflect an increase in muscle and respiratory force, which indicates a relationship between physical activity and pulmonary function in healthy young individuals (Burrows et al., 1983; Robbins et al., 1995).

This study has some limitations that should be considered. First, the cross-sectional design precludes examining the temporal relationships between performance during the 6MWT and clinical outcomes. Second, the number of women was disproportionately higher than that of men; that is, factors specific to women may have affected our results. However, most of the variables were analysed based on predicted values and thus corrected for gender, age, height and weight. Third, the present study involves only healthy young adults, and therefore, the application of our findings to older people requires further research. Fourth, screening for the perception of dyspnoea during exercise in asymptomatic and healthy individuals might be a way to identify the need for more careful medical follow-up (Ziegler et al., 2015); however, the most common diagnosis in this population appears to be that shortness of breath is appropriate and that subjects are reaching their physiological limit (Depiazzi and Everard, 2016). This may inadvertently lead to potentially unnecessary medical investigations and, consequently, increase healthcare costs. Despite these limitations, no previous studies have consistently assessed the association between the 6MWD and the IPAQ categories, degree of dyspnoea and pulmonary function in healthy young adults. Thus, this study may serve as a starting point for a better understanding of the effect of performance on this population beyond the anthropometric and demographic data. This may improve the early detection of underlying clinical abnormalities with the aim of preventing subsequent complications.

5. Conclusion

The present study shows that in healthy young adults, greater pulmonary function indicates a greater 6MWD. In these subjects, physical activity level based on the IPAQ categories apparently affects pulmonary function, particularly FVC. However, the IPAQ category and the degree of dyspnoea are poorly related to the 6MWD of these subjects.

Conflicts of interest

The authors declare no conflicts of interest.

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