COPD

Physical Activity Behaviour in People with COPD Residing in Spain: A Cross-Sectional Analysis

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Abstract

Purpose Chronic obstructive pulmonary disease (COPD) represents a major public health problem due to its high prevalence, morbidity and health cost. It has been demonstrated that physical activity (PA) is one of the most beneficial measures to prevent chronic diseases. The aim of this study was to examine PA levels of adults with COPD residing in Spain, and to analyse the differences by sex, age, education, marital status, cohabiting, tobacco consumption, alcohol consumption and body mass index.

Methods A total of 615 adults aged 15 to 69 years participated in this study. Data from the Spanish National Health Survey 2017 were used. This survey included the short version of IPAQ to measure PA levels. PA was expressed in total volume (MET·min/week), classified as low, moderate and high, and analysed according to sample characteristics. Statistical significance was set at $p < 0.05$ (CI = 95%).

Results Level of PA was higher in men than in women (1808.8 vs. 1575.6 MET·min/week; $p = 0.016$), in those aged under 30 years than in those older than 60 years (2129.4 vs. 1381.4 MET·min/week; $p = 0.047$) and in those who drank alcohol than in those who did not drink (1912.8 vs. 1248.2 MET·min/week; $p = 0.004$). Also, underweight and obese participants participated in lower levels of PA than normal weight participants ($p = 0.001$). When classifying PA level, a total of 37.9% had a low level, 47.5% had a moderate level and only 14.6% had a high level of PA ($p < 0.001$).

Conclusion It is recommendable to implement programs to raise awareness of the importance and benefits of PA in the control of COPD, and these programs should focus on those with lower levels of PA.

Keywords Physical exercise · Lung disease · Public health · Adults

Introduction

Chronic Obstructive Pulmonary Disease (COPD) represents an important challenge for public health because of its increasing prevalence, high morbidity and socioeconomic burden [1]. Moreover, a large body of literature shows that COPD is associated with a decline in patient's quality of life [2]. Indeed, currently COPD is the forth cause of global death [3, 4], and in 2012, more than 3 million people died because of COPD, representing 6% of all global mortality.

Spanish national data collected in the EPI-SCAN study found a COPD prevalence of 10.2% in people aged 40 to 80 years, with an unequal distribution between the sexes: 15.1% in men versus 5.7% in women [5]. This study defined COPD by the GOLD criteria where the ratio between forced expiratory volume in the first second (FEV_1) and the forced vital capacity (FVC) is < 0.70 post-bronchodilator use. Following these findings, it was extrapolated that a 2,185,764 people in Spain suffer from COPD [6]. Importantly, a total of 10% of primary care consultations, 40% of neumology consultations and 7% of annual hospitalizations in Spain are owing to COPD. In those with COPD comorbidities, cardiovascular, metabolic, musculoskeletal and psychological comorbidities are high [7]. These comorbidities are likely driving the high rate of hospitalization. Therefore, in order

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to minimize the economic burden of COPD, such comorbidities need to be prevented.

It is important to underline that COPD prevalence rises with age and it is more frequent in men. This may be owing to the accumulative effect of other risk factors to which individuals have been exposed to throughout life, including behavioural factors [e.g. tobacco smoking, low levels of physical activity (PA)], environmental factors (e.g. air pollution, biomass fuel), physiological factors (e.g. genetic abnormalities) and social factors (e.g. socioeconomic status) [1]. One important observed risk factor for COPD is a lower level of cardiorespiratory fitness across the lifespan [8]. Indeed, maintaining adequate levels of PA allows one to improve cardiorespiratory fitness. When possible, all populations should participate in PA, and if done in natural environments exposure to other COPD risk factors such as air pollution may be reduced [9–11].

Regular and sustained participation in PA aids the prevention of several chronic diseases, and importantly for those with COPD, in both primary and secondary prevention [12, 13]. PA is limited by COPD [14] even in early stages [15, 16]. This limitation in levels of PA is related to a high risk of hospitalization and readmission [17] and even death [18, 19].The lack of PA in COPD's patients is not only conditioned by respiratory functional impairment. There are other determinants that affect patients' PA like dyspnoea, hyperinflation, age and peripheral muscle weakness [20]. Nonetheless, regular participation in PA is related to a better quality of life [21–23] and fewer morbidities in people with COPD [17, 24]. In a prospective cohort study carried out in Barcelona (Spain), participants with COPD who walked for at least 1 h a day had less risk of admission by COPD exacerbation [22]. In a recent prospective observational study, where the clinic efficacy of a walking program in COPD patients was evaluated, there were improvements in both quality of life and exacerbation's number [21]. Despite these, a small body of evidence on patients with COPD shows a tendency towards a sedentary lifestyle [25, 26]. However, these studies have been carried out in small samples and therefore not representative of the wider population. Moreover, little research to date has been carried out on this topic in Spain; as barriers and facilitators to PA differ between countries, owing to social and political context, it is important to establish levels of PA in those with COPD in each country in order to inform policy and practice. To the best of our knowledge, just one study has analysed differences in PA between sex and age in adults with COPD. This determined PA volume is lower in women, but is less than the value obtained in healthy adults in both sexes. According to age, it has been shown that PA volume is lower in older adults [27].

It is believed that people with COPD do not practise enough PA. Moreover, it has been suggested that PA is lower in women than in men, in older adults, in tobacco and alcohol consumers, in those from a lower socioeconomic status and in those with a higher body mass index (BMI), among adults with COPD.

Therefore, the aim of this study was to examine the level of PA in people with COPD residing in Spain, and to analyse the differences according to sex, age, level of studies, marital status, cohabiting, tobacco consumption, alcohol consumption and BMI.

Methods

Sample

Data from the Spanish National Health Survey 2017 were analysed. This survey was undertaken in Spain between October 2016 and October 2017. Details of the survey method have been published elsewhere [28]. In brief, for the data collection, a stratified three-stage sampling was used in which the census sections were first considered, then the family dwellings and then an adult (15 years or more) was selected within each dwelling. The dwellings were selected by systematic sampling and to select the person who had to complete the Adult Questionnaire the random Kish method was used. For this study, inclusion criteria were as follows: (1) affirmative answer to the question "Have you ever been diagnosed with COPD?" and (2) age between 15 and 69 years because this is the age range in which PA level of the survey respondents was evaluated. The age group of adults ≥ 70 years was not considered in this study as they did not complete the IPAQ short form.

This research was conducted in accordance with the Declaration of Helsinki, 1961 (revised in Tokyo in 1989 and in Edinburgh in 2000) and ethical approval was granted by Investigation Ethics Commission of the University of Murcia (Spain).

Instruments

IPAQ short form was used to measure PA. Please see https://sites.google.com/site/theipaq/ [29] for the full survey. This is an instrument designed primarily for population surveillance of PA among adults, and it has been developed and tested for use in adults (age range of 15–69 years), and until further development and testing is undertaken the use of IPAQ with older and younger age groups is not recommended [30]. IPAQ has been validated in adult populations from different countries showing acceptable validity ($\rho = 0.30$, 95% CI 0.23–0.36) and reliability (Spearman's $\rho = 0.81$, 95% CI 0.79–0.82) [31].

Procedure

Participants completed a questionnaire that included sociodemographic questions (age, sex, level of studies and marital status), physical characteristics (weight and height), PA levels, smoking habits and alcohol consumption. The selection of the control variables was based on the past literature [32, 33]. PA levels were assessed with the short version of the IPAQ. PA level was calculated following the formula for computation of MET·min/week, established in the guidelines for data processing and analysis of the IPAQ [30]. Subsequently, PA level was classified as follows: low (less than 600 MET·min/week), moderate (at least 600 MET·min/week) and high (at least 3000 MET·min/week), according to the same guidelines. All of them signed an informed consent form before responding to the survey questions.

Age was divided in three groups: < 30 years, between 30 and 60 years, and 60 years or older. Level of education was classified as university and no university (no studies, primary studies, secondary studies, A level, middle grade and major grade). Marital status was categorised as married and not married (single/widow/divorced/separated). Cohabiting was categorised as yes or no. Alcohol consumption was treated as a dichotomous variable: yes or no, considering as no consumption for those who had not drunk alcohol in the last 12 months and for those who had never drunk alcohol. Smoking was classified in three groups: those who smoked currently, those who did not smoke currently but had smoked before and those who had never smoked [34]. BMI was classified as underweight (< 18.5 kg/m^2), normal weight ($18.5–24.9$ kg/m^2), overweight ($25–30$ kg/m^2) and obesity (> 30 kg/m^2), according to the methods established by the Spanish National Health Survey [28].

Data Analysis

Descriptive statistics (frequency and percentage) was used to describe demographic characteristics. To describe the PA level (MET·min/week) of the participants according to sex, age, level of education, marital status, smoking habits, alcohol consumption and BMI, descriptive statistics were used. To prove the normality of data, Chi-square test was used for categorical variables and Kolomogorov-Smirnov test for continuous variables. Statistical significance was calculated with Mann–Whitney U test for dichotomous variables (sex, education level, marital status and alcohol consumption) and Kruskal–Wallis H test for polytomous variables (age, smoking habits and BMI).

Significant differences in PA level classification between groups in each variable were investigated using crosstabs, including Chi-square test and adjusted residual values. In those variables in which Chi-square tests were significant, the p-value of each box was calculated based on the adjusted residual value in order to know between which groups the differences existed.

Moreover, the effect size was calculated using Cohen's d. Finally, Pearson Correlation was applied to measure the correlation between physical activity and age.

Statistical significance was set at $p < 0.05$ (CI = 95%). Analyses were carried out with the Statistical Package for Social Sciences (SPSS), version 23.

Results

The sample consisted of 615 adults residing in Spain (327 women and 288 men). Participants' average age was 52.7 years (SD 14.1; range 15–69; Mo: 66). Sample characteristics are shown in Table 1.

The total amount of participants' PA is shown in Table 2. There were significant differences between sexes, with men more physically active. Participants under 30 years were significantly more active than those over

Table 1 Sample characteristics

Total sample ($n = 615$)	N	%
Sex		
Women	327	53.2
Men	288	46.8
Age		
< 30	50	8.1
30–60	323	52.5
≥ 60	242	39.3
Education level		
No University	535	87.0
University	80	13.0
Marital status		
Married	322	52.4
Not married	293	47.6
Living in couple		
Yes	327	53.5
No	284	46.5
BMI		
Underweight	22	3.6
Normal weight	195	31.7
Overweight	229	37.2
Obesity	169	27.5
Smoking		
Currently	205	33.3
Not currently	207	33.7
No, never	203	33.0
Alcohol last 12 month		
Yes	404	65.7
No	211	34.3

Table 2 Total amount of physical activity in Met·min/week, according to sample characteristics

	n	Av	SD	Med	IQR	p	d
Sex							
Women	327	1575.6	2517.4	816.0	1668.0	0.016*	0.1952
Men	288	1808.8	2191.6	1122.0	2046.0		
Age							
1. $< 30^3$	50	2129.4	2820.0	1386.0	1670.6	0.047*	0.3555
2. 30–60	323	1843.3	2571.0	990.0	1828.8		0.2039
3. $\geq 60^1$ (Ref.)	242	1381.4	1926.4	706.5	1845.0		–
Education level							
No university	535	1628.3	2330.5	942.0	1831.5	0.140	0.1771
University	80	2062.5	2612.8	1386.0	2427.0		
Marital status							
Married	322	1577.8	2179.3	990.0	1782	0.944	0.0057
Not married	293	1802.3	2564.5	924.0	1994		
Living in couple							
Yes	327	1595.3	2224.1	990.0	1831.5	0.784	0.0222
No	284	1800.7	2541.1	933.0	1842.0		
Smoking							
Currently (Ref.)	205	1770.9	2799.6	792.0	1551.0	0.559	–
Not currently	207	1779.8	2303.9	990.0	2419.5		0.0035
No, never	203	1500.9	1927.1	990.0	1770.0		0.1122
Alcohol (last 12 months)							
Yes	404	1912.8	2683.4	1039.5	2049.0	0.004*	0.2825
No	211	1248.2	1527.1	792.0	1858.5		
BMI							
1. Underweight^2	22	1420.8	2424.3	495.0	2076.7	0.001*	0.2773
2. Normal weight^{1,4} (Ref.)	195	2146.9	2639.1	1386.0	2343.0		–
3. Overweight	229	1660.5	2318.4	966.0	1782.0		0.1968
4. Obesity^2	169	1218.9	2000.9	693.0	1406.2		0.3925
Total	615	1684.8	2371.4				

Superscript numbers indicate significant differences between groups

n Sample size, *Av* average, *SD* standard deviation, *Med* median, *IQR* interquartile range, *d* Cohen's d, *Ref* Reference category

*Statistical significance at $p < 0.05$

60. In addition, when Pearson correlation was applied, a low negative correlation between age and physical activity was observed ($r = -0.129$; $p = 0.001$). Those who drank alcohol did more PA than those who did not drink. There were also significant differences in BMI between underweight and normal weight participants, and between normal weight and obesity participants, in favour of those with normal weight.

In Table 3, PA level is classified as low, moderate and high. No significant differences were found between the categories of each variable for each PA level, except in BMI, as the high level of PA was significantly more frequent in those with normal weight. Considering the entire sample, significant differences were observed ($p < 0.001$), with the moderate level being the most frequent (47.5%) PA level.

Discussion

The total volume of PA for people with COPD that participated in this study was 1684.8 MET·min/week. This level of PA is higher than the recommendations of the Centres for Disease Control and Prevention (CDC) [35] and the World Health Organization [36], which recommends a total volume of 600 MET·min/week. Nevertheless, the total volume of PA in the present study is lower than the value observed in the international validation of IPAQ Short version (957 participants from 12 different countries), which established the average value in healthy adults to be 2514 MET·min/week [31].

Recently, Carsin et al. [37] compared the data of two prospective cohort studies: European Community Respiratory Health Survey (ECRHS) [38] and Swiss Study on

Table 3 Classification of PA level following IPAQ guidelines, according to sample characteristics

| | n | PA level | | | d |
		Low	Moderate	High	
Sex					
Women	327	132 (40.4)	158 (48.3)	37 (11.3)	0.1985
Men	288	101 (35.1)	134 (46.5)	53 (18.4)	
Age					
<30	50	15 (30.0)	28 (56.0)	7 (14.0)	0.1036
30–60	323	116 (35.9)	152 (47.1)	55 (17.0)	
≥60	242	102 (42.1)	112 (46.3)	28 (11.6)	
Education level					
No university	535	205 (38.3)	256 (47.9)	74 (13.8)	0.1142
University	80	28 (35.0)	36 (45.0)	16 (20.0)	
Marital status					
Married	322	116 (36.0)	167 (51.9)	39 (12.1)	0.1985
Not married	293	117 (39.9)	125 (42.7)	51 (17.4)	
Living in couple					
Yes	327	122 (37.3)	163 (49.8)	42 (12.8)	0.1142
No	284	109 (38.4)	127 (44.7)	48 (16.9)	
Smoking					
Currently	205	77 (37.6)	95 (46.8)	33 (15.6)	0.1811
Not currently	207	77 (37.2)	93 (44.9)	37 (17.9)	
No, never	203	79 (38.9)	103 (50.7)	21 (11.3)	
Alcohol (last 12 months)					
Yes	404	142 (35.1)	191 (47.3)	71 (17.6)	0.2437
No	211	91 (43.1)	101 (47.9)	19 (9.0)	
IMC*					
Underweight	22	13 (59.1)	7 (31.8)	2 (9.1)	0.3667
Normal weight	195	62 (31.8)	90 (46.2)	43 (22.1)	
Overweight	229	83 (36.2)	115 (50.2)	31 (13.5)	
Obesity	169	75 (44.4)	80 (47.3)	14 (8.3)	
Total*	615	233 (37.9)	292 (47.5)	90 (14.6)	0.9075

Values are expressed in frequency (%)

n sample size

*Statistical significance at $p < 0.05$

Air Pollution and Lung Disease in Adults (SAPALDIA) [39]. In both, PA was evaluated using the IPAQ questionnaire, as in the present study. Specifically, it was in the ECRHS ($n = 3570$) where the short version was used. The ECRHS study showed a total volume of 1770 MET·min/week in those participants with restrictive spirometric pattern ($n = 143$). This value is slightly higher than the value obtained in the present study (1684.8 MET·min/week). A possible explanation for this difference could be the different age range (20–44 in ECRHS and 15–69 in the present study). In fact, in the present study, PA level was lower in older adults.

It is important to underline that in the vast majority of papers in which PA of people with COPD is studied, the sample is entirely men or with a small percentage of women [40, 41]. Also in Spain the prevalence of COPD is higher in men and older people [1, 5]. However, in the present study, the percentage of women (53.2%) was similar and higher than the percentage of men with COPD (46.8%) and we found that women practised significantly less PA than men. There is no existing literature about why women with COPD practise less PA than men. But regarding people with other diseases, in a study about barriers to practise PA in people with diabetes, it was found that lack of time, lack of knowledge and health limitations were the main reasons, and the last one was identified to be more important in women than in men [42]. This could be owing to women normally practising PA owing to extrinsic motivations such as improving physical aspects or health, but not because they enjoy it [43]. The limited respiratory capacity because of COPD could make it difficult to engage in a PA programs for women owing to a lack of intrinsic motivation.

According to tobacco consumption, significant differences in PA were not found between smokers, ex-smokers and non-smokers with COPD. In the same way, Carsin et al. [37] did not find consistent evidence between restrictive spirometry pattern and low PA. On the other hand, in a prospective cohort study, it was shown that moderate to high levels of regular PA were associated with a lower lung function decline in active smokers, so the risk of developing COPD was reduced [17]. However, a systematic review and meta-analysis of studies performed in 28 countries between 1990 and 2004 [44] and an epidemiological study in Japan [45] concluded that the prevalence of COPD was appreciably higher in smokers and ex-smokers compared with non-smokers. The present study found similar findings in which 67% of participants were smokers or ex-smokers and only 33% were non-smokers.

In reference to alcohol consumption, this study showed that those who drank alcohol did more PA than those who did not drink. The vast majority of the participants (65.7%) drank alcohol. However, it is important to highlight that in this group all participants who drank alcohol were included, even those who only drank once a month or even less. An explanation for the finding that those with COPD and who drink are more physically active than those who have COPD and don't drink is elusive and further research of a qualitative nature is required to understand this relationship.

The present study showed that normal weight participants practised more PA (2146.9 MET·min/week) than overweight (1660.5 MET·min/week) and underweight (1420.8 MET·min/week) COPD patients. Similarly, Mesquita et al. [33] found that clusters of patients with COPD who were more sedentary had higher BMI (couch potatoes: 30.4 kg/

m^2; highly sedentary: 25.7 kg/m^2; sedentary movers 24.9 kg/m^2; sedentary exercisers 23.1 kg/m^2; busy bees 22.5 kg/m^2).

Several studies have confirmed that PA programs in people with COPD improve their quality of life. In 2010, Breyer et al. [46] were the first to show that Nordic Walking is a feasible, simple and effective physical training modality for patients with COPD. This modality is cheap and easy accessible, and the study demonstrated that Nordic Walking has a long-term effect on patients' daily PA pattern and a reduction in daily symptoms of COPD. Subsequently, Barberán-García et al. [47] suggested that Nordic walking could be an appropriate training modality for patients with moderate to severe COPD because it generated higher intensity at the same rate of perceived exertion (RPE) than standard walking.

Main strengths of this study are the large sample of people with COPD and the use of a validated and internationally recognized questionnaire to evaluate PA level. However, it also has potential limitations including the lack of classification of severity of airflow obstruction and grade of dyspnoea. Presence of comorbidities or other barriers that could affect PA practice were not considered. Moreover, as it was an observational study and not a randomized trial, the association can be demonstrated, but not the causality. In future researches it will be recommendable to use accelerometers in order to measure PA in this kind of population and take into account the severity, comorbidities and barriers to PA practice.

Conclusion

Almost four out of ten people with COPD residing in Spain had a low level of PA. The level of PA was higher in men, in those aged less than 60 years, in those who drank alcohol, and in those with normal weight. Therefore, it is recommendable to implement programs to raise awareness of the importance and benefits of PA in the control of COPD among those with COPD residing in Spain, and these programs should focus on women, those older than 60 years, those who do not drink alcohol, and those who do not have a normal weight. These programs should include activities that motivate the participants to do long-term PA. In this way, they could reach PA recommendations and, consequently, they would improve their quality of life.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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