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Effects of Pulmonary Rehabilitation in Men Compared to Women with Chronic Obstructive Pulmonary Disease in Colombia

Theme: Chronic care.

Contribution to the subject: Chronic Obstructive Pulmonary Disease (COPD) generates disability and deterioration of quality of life because it impairs the level of functional independence, thus increasing the care demands and the assistance provided by the health personnel, especially that of Nursing and the rehabilitation-related professions, due to the high level of dependence in the self-care activities and the frequent administration of medications seeking to control bronchial obstruction. This study helps to understand the major importance of the interdisciplinary team to promote assistance to patients with COPD in the pulmonary rehabilitation programs. In addition, it allows differentiating the effects of the interventions according to the patients' gender on the improvement of the aerobic capacity, dyspnea, quality of life, and level of functional independence.

ABSTRACT

Objective: To determine the effects of pulmonary rehabilitation in men and women with a COPD diagnosis in a Colombian clinic. **Method:** A longitudinal and descriptive study was conducted with 75 COPD patients who entered a pulmonary rehabilitation program during 2018 and 2019. The population was divided into groups according to gender and some sociodemographic characteristics were assessed, such as spirometry expressed in percentage of the predicted value, body mass index, mMRC dyspnea, and capacity for physical exercise,

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as well as some physiological variables with the six-minute walk test, anxiety-depression (HADS) and quality of life (SGRQ). A p-value <0.05 was considered statistically significant. **Results:** The cigarette packs smoked per year index was higher in men, 34 ± 29.11 ($p<0.001$), whereas the exposure to firewood smoke was five times higher in women ($p=0.037$). All the variables related to the capacity for physical exercise improved significantly ($p<0.021$), with distance covered standing out: 63.26 ± 60.03 vs. 51.53 ± 61.02 in favor of women. mMRC dyspnea was initially higher in women when compared to men, 0.709 ± 0.287, and presented a greater change in women with 1.294 ± 0.415 when compared to men, 0.736 ± 0.880, at the end of pulmonary rehabilitation. **Conclusion:** Pulmonary rehabilitation in women shows an increase of 63.26 meters in the distance covered and a 1.294-point reduction in dyspnea; while, for men, these figures were 51.53 meters and 0.736 points, respectively, as well as an improvement in quality of life in men by 11.47 SGRQ points when compared to women: 0.600.

KEYWORDS (Source: DeCS)

Rehabilitation; lung diseases; sex; dyspnea; quality of life; exercise.

Efectos de la rehabilitación pulmonar en hombres vs. mujeres con enfermedad pulmonar obstructiva crónica en Colombia

RESUMEN

Objetivo: determinar los efectos de la rehabilitación pulmonar en hombres y mujeres con diagnóstico de EPOC en una clínica de Colombia. **Método:** estudio descriptivo longitudinal en 75 pacientes con EPOC que ingresaron a un programa de rehabilitación pulmonar durante el año 2018 y 2019. La población se dividió en grupos según el sexo y se evaluaron algunas características sociodemográficas, la espirometría en porcentaje del predicho, el índice de masa corporal, la disnea mMRC, la capacidad de ejercicio y algunas variables fisiológicas con el test de la caminata de los seis minutos, la ansiedad-depresión (HADS) y la calidad de vida (SGRQ). Se tuvo un valor $p<0,05$ como estadísticamente significativo. **Resultados:** el índice paquetes fumados por año fue mayor en hombres 34 ± 29.11 ($p<0,001$), mientras que la exposición al humo de leña fue cinco veces mayor en las mujeres ($p=0,037$). Todas las variables de capacidad de ejercicio mejoraron significativamente ($p<0,021$), sobresaliendo la distancia recorrida $63,26\pm60,03$ versus. $51,53\pm61,02$ a favor de las mujeres. La disnea mMRC fue inicialmente mayor en las mujeres comparado con hombres $0,709\pm0,287$ y evidenció un mayor cambio en las mujeres $1,294\pm0,415$ versus hombres $0,736\pm0,880$ al final de la rehabilitación pulmonar. **Conclusión:** la rehabilitación pulmonar en mujeres muestra un incremento en la distancia recorrida de 63,26 metros, disminución de 1,294 puntos en la disnea, para hombres 51,53 metros y 0,736 puntos respectivamente, y una mejoría en la calidad de vida en hombres de 11,47 puntos SGRQ con respecto con mujeres de 0,600.

PALABRAS CLAVE (Fuente DeCS)

Rehabilitación; enfermedades pulmonares; sexo; disnea; calidad de vida; ejercicio físico.

Efeitos da reabilitação pulmonar em homens vs. mulheres com doença pulmonar obstrutiva crônica na Colômbia

RESUMO

Objetivo: determinar os efeitos da reabilitação pulmonar em homens e mulheres com diagnóstico de DPOC em uma clínica na Colômbia. **Método:** estudo descritivo longitudinal em 75 pacientes com DPOC que ingressaram em programa de reabilitação pulmonar durante os anos de 2018 e 2019. A população foi dividida em grupos de acordo com o sexo e foram avaliadas algumas características sociodemográficas, espirometria em porcentagem do previsto, índice de massa corporal, mMRC dispneia, capacidade de exercício e algumas variáveis fisiológicas com o teste de caminhada de seis minutos, ansiedade-depressão (HADS) e qualidade de vida (SGRQ). Considerou-se o valor de $p < 0,05$ como estatisticamente significativo. **Resultados:** a taxa de fumaça de maços por ano foi maior nos homens $34 \pm 29,11$ ($p < 0,001$), enquanto a exposição à fumaça de lenha foi cinco vezes maior nas mulheres ($p = 0,037$). Todas as variáveis da capacidade de exercício melhoraram significativamente ($p < 0,021$), destacando-se a distância percorrida $63,26 \pm 60,03$ versus $51,53 \pm 61,02$ a favor das mulheres. O mMRC dispneia foi inicialmente maior nas mulheres em relação aos homens $0,709 \pm 0,287$ e evidenciou maior alteração nas mulheres $1,294 \pm 0,415$ versus homens $0,736 \pm 0,880$ ao final da reabilitação pulmonar. **Conclusão:** a reabilitação pulmonar em mulheres mostra um aumento na distância percorrida de 63,26 metros e uma diminuição de 1.294 pontos na dispneia, enquanto para os homens os valores obtidos foram 51,53 metros e 0,736 pontos, respectivamente, e uma melhoria na qualidade de vida nos homens de 11,47 pontos do SGRQ em relação às mulheres, onde foi de 0,600 pontos.

PALAVRAS-CHAVE (Fonte: DeCS)

Reabilitação; pneumopatias; sexo; dispneia; qualidade de vida; exercício físico.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) has historically had a connotation of male predominance, mainly associated with the smoking habit (1). On the other hand, it has been described that the prevalence of COPD is higher in men than in women in any age group (2); furthermore, in countries like China, its prevalence is two-fold in men (3). However, in other countries, the smoking habit can even be stronger in women, and higher prevalence is evidenced in this population (2,4).

It is important to consider that, in patients with COPD, two types of interventions are recommended: pharmacological and non-pharmacological, this latter being of great relevance as it includes pulmonary rehabilitation; however, it has been evidenced that the medical personnel can better diagnose COPD in men than in women, which affects treatment, allowing men greater access to the health services (4,5,6).

Several authors suggest that COPD has different physiological and psychological impacts in men than in women (5,7). The evidence indicates that men and women can be phenotypically different in their response to the smoke from tobacco, and even to other risk factors of the disease, reason why their intervention needs could vary according to the clinical and functional condition (8). Although the benefits of the interventions are equally manifested both in men and for women, it is important to consider that the effects of pulmonary rehabilitation can bring about different outcomes according to gender, which renders it necessary that, in some conditions, individualization of the interventions be indispensable to denote benefits in similar proportions (8).

On the other hand, in Latin America, the studies investigating COPD considering the patients' gender are scarce; and it is even rarer to find studies in which there is evidence of the changes in the aerobic capacity, anxiety or depression, and quality of life, the latter being related to the health of male and female patients who undergo pulmonary rehabilitation (PR). For this reason, the objective of this study was to determine the effects of pulmonary rehabilitation in men and women with a COPD diagnosis in a clinic in the city of Cali, Colombia.

Methods

This is a longitudinal and descriptive study. It was conducted from July 2018 to July 2019 and two groups of patients with COPD were linked according to gender (men and women), which was corroborated by the patients' medical record.

Participants

A total of 75 male and female patients with a medical diagnosis of COPD (chronic bronchitis and pulmonary emphysema types) were included in the study. They underwent pulmonary rehabilitation (PR) in the city of Cali, Colombia. The study was approved by the ethics committee of the clinic and adopted the norms outlined in Resolution 8,430 of the Ministry of Health and Social Protection and the Declaration of Helsinki. The following were adopted as inclusion criteria: a) patients who signed the informed consent; b) diagnosis by post-bronchodilator spirometry, according to the American Thoracic Society guidelines (9); and c) first-time participation in a PR program. Whereas the exclusion criteria were as follows: a) cognitive change which limited assessment; and b) uncontrolled heart or metabolic diseases.

Instruments and materials

The following variables were taken into account in this study: age, gender, socioeconomic status, marital status, a smoking habit with its respective index of packs smoked per year (P/Y), exposure to firewood smoke, use of home oxygen, FEV_1, FVC, FEV_1/FVC in post-bronchodilator spirometry expressed in percentage of the predicted value, Body Mass Index (BMI), and modified Medical Research Council (mMRC) dyspnea in the activities of daily living (10). In turn, the Six-Minute Walk Test (6MWT) was performed at the beginning and the end of PR following all the ATS (11) recommendations and recording the following data: distance covered, estimated Oxygen Consumption (VO_2), METS, respiratory frequency, Borg's dyspnea and fatigue in the lower limbs according to Borg's modified scale, SpO_2 at the beginning and at the end, and degree of desaturation at the end of the stop test during the 6MWT.

Once the 6MWT was finished, the patients answered the *Anxiety and Depression* questionnaire, assessed with the Hospital Anxiety and Depression Scale (HADS), which has 14 items and

2 subscales with 7 items each; one for anxiety and the other for depression. In this way, scores over 11 points are indicative of clinical problems; scores between 8 and 10 points are considered probable, and results below 8 points are considered normal (12).

Subsequently, the *Saint George´s Respiratory Questionnaire* (SGRQ) (13) for health-related quality of life (HRQoL) was administered, which consists of 50 questions grouped into three domains: symptoms (8 items), activity (16 items), and impact (26 items). The results are expressed as percentages and the final score varies from zero (best performance) to one hundred (worst performance) (12).

Pulmonary rehabilitation program

All the patients are assessed by a pulmonologist before entering the program. This professional determines the inclusion criteria for the PR program; once the patients are referred to the program, they are assessed by a physiotherapist specialized in cardiac and pulmonary rehabilitation that defines the intervention objectives for each of them. The PR program was conducted during 24 sessions distributed in 3 sessions per week for a total of 8 weeks. Physical exercise activities were performed in each PR session. They presented the following routine: general warming and muscle strengthening exercises (4 series of 12 repetitions) in the first weeks with 50 % of maximum resistance (MR) for upper and lower limbs, and MR was increased to 60 % after 4 weeks. The estimation of MR was carried out based on the number of times that the patients managed to make each movement assessed using the correct technique (14); subsequently, the continuous exercise was executed on a treadmill for 30 minutes, beginning at 60 % of the estimated VO_2 reached in the aerobic capacity test (6MWT).

The estimation of VO_2 was calculated with the following formula: $VO_2 = 3.5$ ml/kg/min + (Speed m/min × 0.1) and, in turn, the calculation of the METS was performed by METS = $VO_2/3.5$ (15), which allowed prescribing physical exercises in a precise manner for each of the participants. The progression in the intensity of the continuous exercise on the treadmill was guided considering Borg's modified scale; for this, speed and angle were changed, maintaining a score between 3 (moderate) and 5 (severe) (16) for each of the sessions. The educational component was also implemented, which consisted of individual and group sessions on topics such as knowledge of the disease, importance of quitting smoking, inhalators and their adequate use technique, recognition of the alert signs, home oxygen, adequate nutrition, measures against panic and anxiety, and home breathing exercises (14,17). The individual sessions were conducted during the PR sessions; and the group sessions, once a week, were attended by patients and family members.

Data analysis

A descriptive analysis of all the variables was performed. The qualitative variables are presented as frequency and percentage, whereas the behavior of each quantitative variable was assessed using normality tests using Kolmogorov-Smirnov's test, which presents results in mean values and standard deviations. The difference between the data found according to gender at the beginning and the end of the program was determined from the Student's t-test for independent samples; on the other hand, to determine the changes presented by the men and women after PR, the Student's t-test for paired samples was applied. A p-value below 0.05 was considered statistically significant for the variables analyzed at the beginning and the end of the study.

Results

Table 1 shows the patients' sociodemographic characteristics. The total population consisted of 75 patients, mainly men (55). In the men, the mean age was 70.78 ± (8.636) and, in the women, 70.85 ± (10.36). More than 90 % of the participants live in the city of Cali and less than half of the men (43.6 %) and the women (45 %) presented excess weight. The marital status of most of the men was stable union (70.9 %), in opposition to the women, who were mostly in unstable relationships ($p=0.01$). Concerning the smoking habit, most of the men (90.9 %) and women (65 %) were smokers ($p=0.019$). Also, it was found that more than half of the men (54.4 %) and the women (65 %) belonged to the middle and high socioeconomic strata, which identifies the access capacity to the rehabilitation services of the population with more resources. They belonged to the contributive health regime (81.8 % vs. 85 %), did not use home oxygen (52.7 % vs. 50 %), had been admitted to urgency departments (69.1 % vs. 70 %), and hospitalized (58.2 % vs. 50 %) in the last year, respectively. In addition, although exposure to firewood smoke was relatively low in the total population, it was observed that 40 % of the women were exposed, against 16.4 % of the men.

Table 1. Characteristics of the men and women

Variables	Men n=55	Women n=20	p-value
Age	70.78 ± (8.636)	70.85 ± (10.36)	0.977
Grouped marital status			
Stable union	39 (70.9 %)	7 (35.0 %)	0.010
No stable union	16 (29.1 %)	13 (65.0 %)	
Grouped place of residence			
Cali	50 (90.0 %)	19 (95.0 %)	0.923
Outside Cali	5 (9.1 %)	1 (5.0 %)	
Stratum			
Low	25 (45.5 %)	7 (35.0 %)	0.585
Middle/High	30 (54.5 %)	13 (65.0 %)	
HPE			
Subsidized	10 (18.2 %)	3 (15.0 %)	0.982
Contributive	45 (81.8 %)	17 (85.0 %)	
Home oxygen			
Yes	26 (47.3 %)	10 (50.0 %)	0.958
No	29 (52.7 %)	10 (50.0 %)	
Urgency departments			
Yes	38 (69.1 %)	14 (70.0 %)	0.836
No	17 (30.9 %)	6 (30.0 %)	
Hospitalization			
Yes	32 (58.2 %)	10 (50.0 %)	0.712
No	23 (41.8 %)	10 (50.0 %)	
BMI classification			
Thin	6 (10.9 %)	1 (5.0 %)	0.742
Normal	25 (45.5 %)	10 (50.0 %)	
Excess weight/Obesity	24 (43.6 %)	9 (45.0 %)	
Smoked			
Yes	50 (90.9 %)	13 (65.0 %)	0.019
No	5 (9.1 %)	7 (35.0 %)	
Exposure to firewood smoke			
Yes	9 (16.4 %)	8 (40.0 %)	0.064
No	46 (83.6 %)	12 (60.0 %)	

Meanwhile, Table 2 shows a comparison of the clinical factors between men and women. The mean of the pack/year index was significantly higher in men than in women (34.07 ± 29.11 vs. 9.7 ± 12.01, with an SE of means difference of 24.37 ± 4.758 and a p-value<0.001. The mean time of exposure to firewood smoke in years was also lower in men (1.36 ± 3.941 vs. 6.15 ± 9.315) with an SE of means difference of -4.786 ± 1.524 and a p-value<0.037. Both the visits to urgency departments (2.70 ± 4.835 vs. 0.98 ± 0.991) and the hospitalizations (1.10 ± 1.832 vs. 0.78 ± 0.994) in the last year presented a higher mean value in the women, whereas the number of hospitalization days was higher in the men (8.62 ± 11.62 vs. 6.40 ± 8.016). FEV_1 (44.23 ± 14.89 vs. 43.54 ± 12.92), FVC (69.80 ± 18.78 vs. 67.32 ± 17.82), and FEV_1/FVC (61.24 ± 10.34 vs. 63.25 ± 6.144) were similar to those of the women.

In relation to the changes presented in Table 3 after pulmonary rehabilitation, a clinical improvement with statistical significance (p<0.05) was found in men and women in distance covered (51.53 ± 113.7 meters vs. 63.26 ± 60.03 meters), speed (7.320 ± 13.73 meters/minute vs. 8.144 ± 14.5 meters/minute), estimated VO_2 (1.4 ± 2.229 ml/kg/min vs. 0 806 ±1.452 ml/kg/min), METS (0.399 ± 0.633 METS vs. 0.234 ± 0.415 METS) and mMRC dyspnea (0.736 ± 0.88 vs. 1.294 ± 0.415). Initial mMRC dyspnea was significantly higher in women (3.6 ± 1.273 vs. 2.89 ± 1.031, p<0.001).

There were also clinically positive results in both groups for HAD Anxiety (1.212 ± 4.021 vs. 1.294 ± 3.158) and HRQoL (SGRQ Total [11.47 ± 14.31 vs. 0.6 ± 12.07], SGRQ Symptoms [12.30 ± 21.59 vs. 13.2 ± 24.11], SGRQ Activities [10.37 ± 23.25 vs. 6.8 ± 15.49]), although statistically significant (p<0.05) only in men. The SGRQ total showed statistical significance (p=0.000) with an important clinical improvement only in men, whereas it remained almost unchanged in women (11.47 ± 14.31 vs. 0.6 ± 12.07). The SGRQ presented similar results in men and women in the symptoms (49.22 ± 20.06 vs. 47.45 ± 22.38) and activities (61.07 ± 22.51 vs. 61 ± 24.78) items, but worse in men in the impact (41.04 ± 17.98 vs. 32 82 ± 15.4) and total (50.65 ± 16.3 vs. 45,18 ± 15,41) items, with statistical significance only the group of men, possibly associated to the sample of women being smaller.

Arterial O_2 saturation at rest presented statistical significance in men (p=0.012), although it did not vary in a significant manner between the two groups (-0.887 ± 2.486 vs. -0.278 ± 1.127). Arterial O_2 saturation at the end of the 6MWT in women presented a slight increase with statistical significance (p=0.035), whereas the clinical impact was limited in men (1,333 ± 2.473 vs. -0.094 ± 4.198). Although not reaching statistical significance, the desaturation percentage during the 6MWT at the beginning and the end of pulmonary rehabilitation did present clinical importance in men (6.53 ± 5.228 vs. 6.95 ± 5.880) and in women (4.85 ± 3.843 vs. 5.85 ± 5.412), although the means differences only showed a slight increase of desaturation in women (-1.0 ± 3.261). In the number of stops during the 6MWT, the means difference was statistically significant in the men (0.135 ± 0.397) and did not vary in the women (0.0 ± 1.118). Variables such as respiratory frequency, heart rate, and fatigue did not show important clinical or statistically significant changes in any group.

Table 2. Clinical comparison between men and women with COPD

Variables	Men n=55	Women n=20	SE of means difference	p-value
Visits to urgency departments in the last year	0.98 ± (0.991)	2.70 ± (4.835)	-1.718 ± (3.994)	0.131
Hospitalizations in the last year	0.78 ± (0.994)	1.10 ± (1.832)	-0.318 ± (1.210)	0.468
Days hospitalized	8.62 ± (11.62)	6.40 ± (8.016)	2.218 ± (3.405)	0.434
FEV_1	44.23 ± (14.89)	43.54 ± (12.92)	0.696 ± (6.801)	0.854
FVC	69.80 ± (18.78)	67.32 ± (17.82)	2.473 ± (7.176)	0.611
FEV_1/FVC	61.24 ± (10.34)	63.25 ± (6.144)	-2.003 ± (5.924)	0.311
P/Y index	34.07 ± (29.11)	9.700 ± (12.01)	24.37 ± (4.758)	<0.001
Time of exposure to firewood smoke in years	1.36 ± (3.941)	6.15 ± (9.315)	-4.786 ± (1.524)	0.037

Table 3. Changes in men and women with COPD after pulmonary rehabilitation

Variable	Men n=55 Pre-PR	Men n=55 Post-PR	SE of means difference	p-value	Women n=20 Pre-PR	Women n=20 Post-PR	SE of means difference	p-value
BMI (kg/m^2)	24.14 ± (4.473)	23.77 ± (5.511)	0.467 ± (3.272)	0.303	26.33 ± (6.192)	25.63 ± (5.750)	0.703 ± (2.715)	0.261
Distance covered (meters)	316.2 ± (113.7)	369.4 ± (107.4)	-51.53 ± (61.02)	<0.001	226.1 ± (120.6)	289.4 ± (124.7)	-63.26 ± (60.03)	<0.001
Speed (m/min)	52.71 ± (18.95)	60.43 ± (19.61)	-7.320 ± (13.73)	<0.001	37.68 ± (20.10)	45.82 ± (22.93)	-8.144 ± (14.50)	0.021
HR at rest (bpm)	82.05 ± (13.33)	83.42 ± (11.85)	-1.264 ± (14.60)	0.531	82.00 ± (11.50)	81.06 ± (11.35)	0.833 ± (11.22)	0.757
HR at the end of 6MWT (bpm)	107.2 ± (15.69)	110.2 ± (15.53)	-3.113 ± (12.30)	0.071	104.4 ± (14.64)	102.3 ± (20.65)	2.222 ± (14.00)	0.510
SaO_2 at rest (%)	93.38 ± (3.188)	94.25 ± (3.088)	-0.887 ± (2.486)	0.012	94.50 ± (2.306)	94.94 ± (2.100)	-0.278 ± (1.127)	0.311
SaO_2 at the end of 6MWT (%)	86.85 ± (6.246)	87.06 ± (6.954)	-0.094 ± (4.198)	0.871	89.65 ± (4.475)	88.39 ± (5.992)	1.333 ± (2.473)	0.035
Desaturation (%)	6.53 ± (5.228)	6.95 ± (5.880)	-0.418 ± (4.528)	0.496	4.85 ± (3.843)	5.85 ± (5.412)	-1.000 ± (3.261)	0.186
RF at rest (brpm)	19.87 ± (4.342)	21.42 ± (10.60)	-1.585 ± (10.12)	0.260	19.85 ± (3.435)	19.89 ± (3.197)	0.444 ± (5.090)	0.716
RF at the end of 6MWT (brpm)	26.13 ± (4.982)	26.00 ± (5.446)	0.358 ± (4.884)	0.595	26.30 ± (3.672)	28.56 ± (4.985)	-1.667 ± (5.941)	0.250
Borg at rest	0.47 ± (0.790)	0.30 ± (0.723)	0.189 ± (0.982)	0.168	0.60 ± (0.940)	0.29 ± (0.772)	0.412 ± (0.870)	0.069
Borg at the end of 6MWT	2.04 ± (1.774)	1.72 ± (1.524)	0.321 ± (1.978)	0.243	2.25 ± (1.482)	2.00 ± (1.904)	0.412 ± (2.265)	0.464
Fatigue in LLs at rest	0.40 ± (0.735)	0.32 ± (0.754)	0.094 ± (0.741)	0.358	0.90 ± (1.210)	0.71 ± (1.404)	0.353 ± (0.996)	0.163
Fatigue in LLS at the end	1.51 ± (1.585)	1.72 ± (1.714)	-0.245 ± (1.505)	0.241	2.30 ± (2.250)	1.94 ± (1.819)	0.353 ± (1.693)	0.403
Stops in 6MWT	0.25 ± (0.552)	0.12 ± (0.323)	0.135 ± (0.397)	0.018	0.70 ± (1.129)	0.70 ± (0.831)	0.000 ± (1.118)	1.000
Estimated VO_2 (ml/kg/min)	8.045 ± (2.490)	9.445 ± (2.109)	-1.400 ± (2.229)	<0.001	7.275 ± (2.012)	8.082 ± (2.304)	-0.806 ± (1.452)	0.022
METS	2.297 ± (0.706)	2.697 ± (0.601)	-0.399 ± (0.633)	<0.001	2.081 ± (0.578)	2.315 ± (0.656)	-0.234 ± (0.415)	0.021
mMRC	2.89 ± (1.031)	2.11 ± (1.155)	0.736 ± (0.880)	<0.001	3.60 ± (1.273)	2.41 ± (1.004)	1.294 ± (0.920)	<0.001
HAD: Anxiety	5.75 ± (4.186)	4.62 ± (4.030)	1.212 ± (4.021)	0.034	7.85 ± (5.594)	6.65 ± (4.974)	1.294 ± (3.158)	0.110
HAD: Depression	4.76 ± (3.882)	4.15 ± (3.280)	0.769 ± (3.376)	0.107	4.95 ± (3.486)	4.06 ± (3.631)	0.824 ± (2.430)	0.181
SGRQ Symptoms	49.22 ± (20.06)	37.09 ± (19.89)	12.30 ± (21.59)	<0.001	47.45 ± (22.38)	35.00 ± (24.66)	13.20 ± (24.11)	0.117
SGRQ Activities	61.07 ± (22.51)	49.60 ± (22.97)	10.37 ± (23.25)	0.002	61.00 ± (24.78)	53.00 ± (24.87)	6.800 ± (15.49)	0.198
SGRQ Impact	41.04 ± (17.98)	29.28 ± (17.55)	11.18 ± (15.54)	<0.001	32.82 ± (15.14)	33.60 ± (17.18)	-0.300 ± (8.097)	0.909
SGRQ TOTAL	50.65 ± (16.30)	38.60 ± (17.30)	11.47 ± (14.31)	<0.001	45.18 ± (15.41)	44.50 ± (17.08)	0.600 ± (12.07)	0.879

When comparing the pre- and post- variables between men and women, Table 4 shows that both distance covered (90.18 ± 30.17 vs. 80.03 ± 29,98) and speed (15.03 ± 5.03 vs. 14.61 ± 5.377) presented important and statistically significant clinical differences ($p<0.05$) between men and women, respectively; similarly, estimated VO_2 (0.769 ± 0.62 vs. 1.363 ± 0.564) and METS (0.216 ± 0.176 vs. 0.381 ± 0.160) presented increases, although the latter with statistical significance only at the end of the program. Although the number of stops reached statistical significance at the end of the program, it did not present clinical relevance. SGRQ Impact (8.218 ± 5.804 vs. -4.317 ± 6.033) and SGRQ Total (5.473 ± 5.341 vs. -5.896 ± 5.955) presented a slight clinical advantage in the SE of means difference in favor of the men at the beginning of the program, and an advantage in favor of the women at the end. The rest of the variables do not show clinical or statistically significant changes.

Table 4. Comparisons between men and women at the beginning and the end of the pulmonary rehabilitation program

	Comparison of Pre-PR variables between Men and Women		Comparison of Post-PR variables between Men and Women	
Variable	**SE of means difference**	**p-value**	**SE of means difference**	**p-value**
BMI (kg/m^2)	-2.193 ± (1.299)	0.096	-1.860 ± (1.463)	0.208
Distance covered (meters)	90.18 ± (30.17)	0.004	80.03 ± (29.98)	0.009
Speed (m/min)	15.03 ± (5.030)	0.004	14.61 ± (5.377)	0.008
HR at rest (bpm)	0.055 ± (3.365)	0.987	2.360 ± (3.201)	0.464
HR at the end of 6MWT (bpm)	2.618 ± (4.028)	0.518	7.894 ± (4.623)	0.092
SaO_2 at rest (%)	-1.118 ± (0.779)	0.156	-0.699 ± (0.785)	0.376
SaO_2 at the end of 6MWT (%)	-2.795 ± (1.524)	0.071	-1.332 ± (1.836)	0.471
Desaturation percentage (%)	1.677 ± (1.281)	0.194	1.095 ± (1.504)	0.469
RF at rest (brpm)	0.023 ± (1.078)	0.983	1.526 ± (2.548)	0.551
RF at the end of 6MWT (brpm)	-0.173 ± (1.221)	0.888	-2.556 ± (1.456)	0.084
Borg at rest	0.127 ± (0.217)	0.560	0.008 ± (0.205)	0.970
Borg at the end of 6MWT	-0.214 ± (0.445)	0.632	-0.283 ± (0.452)	0.533
Fatigue in ULs at rest	-0.500 ± (0.288)	0.095	-0.385 ± (0.356)	0.293
Fatigue in ULs at end of 6MWT	0.791 ± (0.547)	0.160	-0.224 ± (0.485)	0.645
Number of stops during 6MWT	-0.445 ± (0.263)	0.104	-0.649 ± (0.207)	0.006
Estimated VO_2 (ml/kg/min)	0.769 ± (0.620)	0.219	1.363 ± (0.564)	0.018
METS	0.216 ± (0.176)	0.224	0.381 ± (0.160)	0.020
mMRC	-0.709 ± (0.287)	0.016	-0.299 ± (0.312)	0.343
HAD: Anxiety	-2.105 ± (1.200)	0.084	-2.032 ± (1.194)	0.094
HAD: Depression	-0.186 ± (0.988)	0.851	0.095 ± (0.941)	0.920
SGRQ Symptoms	1.764 ± (6.752)	0.795	2.094 ± (7.125)	0.770
SGRQ Activities	0.073 ± (7.557)	0.992	-3.396 ± (8.022)	0.674
SGRQ Impact	8.218 ± (5.804)	0.162	-4.317 ± (6.033)	0.477
SGRQ TOTAL	5.473 ± (5.341)	0.309	-5.896 ± (5.955)	0.326

Discussion

This study allowed determining that, in the population under study, men participate more in pulmonary rehabilitation programs when compared to women; and that, despite the growing prevalence in the latter group, COPD affects both genders almost equally (18). This situation can be related to the delay in seeking medical assistance by the women (19) and to the fact that the medical personnel diagnoses the disease to more men because it is related to the smoking habit, which probably leads to more referrals to the PR programs (5,7).

It is noted that, in Colombia, there is growth in the prevalence of women with COPD, whereas the results of the PREPOCOL (20) and PUMA (21) studies reported higher prevalence in men. A more recent study showed that the prevalence between 2010 and 2015 was higher in women (22); nevertheless, this is based on the diagnoses obtained from the medical consultations of the Colombian population and could present underestimations given the difficulty in contrasting with diagnostic tests such as spirometry.

The study entitled *Proyecto Latinoamericano de Investigación en Obstrucción Pulmonar* (PLATINO) (23), conducted in five Latin American countries (Brazil, Chile, Mexico, Uruguay, and Venezuela), also showed that the prevalence of COPD was higher in men; however, in countries such as Sweden and Canada, higher prevalence is reported in women (2,24). This increase in the prevalence of COPD in women is possibly because smoking habit index in high-income countries is similar between men and women, which is in opposition to middle- and low-income countries (1) since the prevalence of COPD is directly related to that of the smoking habit. Added to this, air pollution in closed places due to the burning of wood and other biomass fuels, such as organic sources for energy production, generate gases and harmful particles, thus becoming another important occupational factor of COPD in some countries (18), this type of exposure being more common in women (25).

Regarding the sociodemographic conditions, most of the participants of this study lived in the city of Cali, which aligns with the description by some authors who state that, in our context, the patients with COPD mainly attend pulmonary rehabilitation programs located in the big cities, thus reflecting access to the PR programs (26). It has also been evidenced that the smoking habit is not an exclusive risk factor associated with COPD, as set out by the WHO, and, therefore, there are clear differences in risk factors between men and women (25,27).

In this study, the time of exposure to firewood smoke was 5 times higher in women, which is similar to the national data, where 39 % of the population over 40 years old, living in the five main cities, had cooked with firewood for more than 10 years. Consequently, the risk is higher in women due to their more frequent devotion to the art of cooking (28). This same situation has been reported in a study conducted in China, where exposure to firewood smoke is higher in women and, consequently, it is a more relevant risk factor than the smoking habit (7).

Half of the study population used home oxygen, a condition that could have been related to the severity of the airflow limitation in the total population according to the 2021 GOLD Guide (GOLD 3: severe, FEV_1 mean $<$ 45 %) (18). This is supported by the conclusions of Perincek and Avci (29), who found that BMI, FEV_1, and smoking habit, among others, affect the severity of COPD.

The women presented more admissions to urgency departments and hospitalizations, although the men had longer stays, data that are in agreement with those reported by other authors (19). In addition, Lisspers *et al.* (30) reported a higher risk (12 %) for early exacerbation in men and a higher number of visits to urgency departments, hospitalizations and hospital stays when considering the incidents related to COPD (23).

All the variables related to the capacity for physical exercise showed clinically and statistically significant improvements. The distance covered in the 6MWT test and the pre- and post-PR speeds were higher in the men, but it was the women that presented the most significant change at the end of the program in both variables, evidencing increases of 63.26 meters in distance covered and of 8.144 m/min in speed in the post-PR 6MWT test. In both cases, the clinically significant minimum difference of 35 meters was exceeded (31). Spielmanns *et al.* (32) also found a lower pre-PR distance in women and a greater difference in the distance covered in women post-PR, because the initial walk distance is related to the response probability, since a longer initial walk distance is in line with a reduced response probability, as was the case with the men in our study.

VO_2 and the METS also improved significantly in both groups, although in these two variables the gain was greater in the men since Robles *et al.* (33) reported similar results: the women presented worse pre-PR results than the men and the capacity for physical exercise improved similarly in both genders. Neverthe-

less, in one of the studies reviewed, it was reported that the average improvement did not reach clinical relevance for any of the groups (even when taking 54 m as a clinically significant distance).

Pulmonary function was homogeneous and the mMRC data presented statistical significance in both groups ($p<0.001$), with higher dyspnea numbers both at the beginning and at the end of PR. Nevertheless, a more relevant clinical difference was found pre-PR. According to these data, a systematic review sets outs that, for a similar degree of airflow limitation, women present more dyspnea than men. Likewise, a clinical improvement was found in both groups, as well as greater impact in the women at the end of PR (33). However, reports were also found with similar baseline dyspnea values in both genders, such as the study by Jia G. *et al.* (7) with mMRCm<2.

On the other hand, the initial anxiety level was higher in the women, with a similar clinical improvement post-PR. These results are similar to those reported by other authors (34), who state that women are more concerned about caring for their disease; however, it has been reported that, in PR programs, both genders showed similar anxiety levels and health statuses with similar improvements, although reduced post-PR (33).

The pre-PR depression level and the post-PR improvements presented similar behaviors in both groups. SGRQ also presented an important positive change in both groups concerning symptoms and activities, whereas the impact and total items only improved in men. The systematic review by Robles *et al.* (33) suggests that women present more probabilities of being benefited in terms of dyspnea, health, and psychological state; with respect to HRQoL, the studies did not find gender differences, reason why it is assumed that PR equally benefits men and women in relation to the quality of life (35).

As limitations of this study, it is evidenced that, in the population linkage, there could have been biases in the selection because no randomized sampling selection was performed, which was evidenced in a predominance of linked men in the study. In its turn, the instruments used do not guarantee initial homogeneity between the genders, the reason why their sensitivity to change due to this condition should be a study motivation for future research. The use of mixed-methods studies might help to better understand the results of the interventions based on physical exercise, given that, although both groups experienced significant improvements, these results may be perceived differently according to gender.

Conclusions

In this study, it was evidenced that, when compared to the men, the women presented more dyspnea and lower aerobic capacity before the pulmonary rehabilitation. However, after PR, the women presented improvements of 1.294 points in mMRC dyspnea and 63.26 meters in distance covered related to the aerobic capacity, p-value=<0.001; on the other hand, the men presented reductions of 1.212 points in anxiety, p-value=0.034, and of 11.47 points in quality of life in the total SGRQ domain, p-value=<0.001. Given the above, a different impact is evidenced in pulmonary rehabilitation between men and women; and, for this reason, studies are suggested with interventions targeted at responding to the particular needs of the patients with COPD who require pulmonary rehabilitation.

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