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PULMONARY REHABILITATION PROGRAM OF 36 SESSIONS IMPROVES FUNCTIONAL CAPACITY AND REDUCE BODY MASS LEVEL IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Paulo Sergio Correia Martins[1], Débora Ferreira Moraes Guimarães[1], Roger Medeiros Xavier[2]
Alessandra de Magalhães Campos Garcia[1], Matheus Gomes Castro[1], Cristiano Teixeira Mostarda[2]
Antonio Coppi Navarro[2]

ABSTRACT

Aim: To evaluate the functional capacity through the 6-minutes walk test and the body mass level in patients with Chronic Pulmonary Obstructive Disease, Pulmonary Rehabilitation Program participants, in pre moments, 18 sessions and in the end of 36 sessions. Materials and Methods: In the Pulmonary Rehabilitation Program with 3 weekly sessions per a period of 12 weeks of combine exercises (aerobic and strength), it was realized the 6-minutes walk test, to check the functional capacity, before, 18 sessions and after 36 sessions of Pulmonary Rehabilitation; 20 patients diagnosed with CPOD (15 with moderate CPOD and 5 with grave CPOD) were evaluated; it was also checked the Body Mass Index (BMI) from patients in the same time. Results: It was checked distance covered increase in the 6-minutes walk test, in 18 sessions and in the end of 36 sessions from the program; it was checked the patients' BMI decrease in the end of 36 sessions from rehabilitation program. Discussion: In 18 sessions, it was observed an improvement of 18.75%, as well as in 36 sessions the improvement was 29.47% of covered distance by patients in the 6-minutes walk test; after 18 sessions it has already happened a 3% decrease in BMI and also, with 36 sessions this decrease was 6.24%, showing that way the Pulmonary Rehabilitation Program's efficiency. Conclusion: After 36 sessions, the pulmonary rehabilitation is effective in the improvement of functional capacity and in BMI decrease on patients with COPD.

Key words: COPD. Pulmonary Rehabilitation. Functional Capacity. BMI.

1 - Bacharelado em Educação Física da Universidade Federal do Maranhão, São Luís-MA, Brasil.
2 - Programa de Pós-Graduação Stricto Sensu, Mestrado em Educação Física, São Luís-MA, Brasil.

RESUMO

Programa de reabilitação pulmonar de 36 sessões melhora a capacidade funcional e reduz o índice de massa corpórea em pacientes com doença pulmonar obstrutiva crônica

Objetivo: Avaliar a capacidade funcional através do teste de caminhada de seis minutos e o índice de massa corpórea em pacientes com Doença Pulmonar Obstrutiva Crônica, participantes do Programa de Reabilitação Pulmonar, nos momentos pré, 18 sessões e ao final de 36 sessões. Materiais e Métodos: No Programa de Reabilitação Pulmonar com 3 sessões semanais por um período de 12 semanas de exercícios combinados (aeróbio e força), foi realizado o teste de caminhada de seis minutos, afim de verificar a capacidade funcional, pré, 18 sessões e após 36 sessões de Reabilitação Pulmonar; foram avaliados 20 pacientes diagnosticados com DPOC (15 com DPOC moderada e 5 com DPOC grave); foi verificado também o Índice de Massa Corpórea (IMC) dos pacientes nos mesmos momentos. Resultados: foi verificado aumento da distância percorrida no TC6M, em 18 sessões e ao fim das 36 sessões do programa; também se verificou diminuição do IMC dos pacientes ao fim das 36 sessões do programa de reabilitação. Discussão: em 18 sessões, observou-se uma melhora de 18,75%, assim como em 36 sessões a melhora foi de 29,47% da distância percorrida pelos pacientes no TC6M; pós 18 sessões já ocorreu uma redução de 3% no IMC e com 36 sessões essa redução foi a 6,24%, demonstrando assim a eficiência do programa de reabilitação pulmonar. Conclusão: A reabilitação pulmonar após 36 sessões é eficaz na melhora da capacidade funcional e na redução do IMC de pacientes com DPOC.

Palavras-chave: DPOC. Reabilitação Pulmonar. Capacidade Funcional. IMC.

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INTRODUCTION

The Chronic Obstructive Pulmonary Disease (COPD) it is a respiratory disease characterized by existence of airflow chronic obstruction, that it is not completely reversible.

The airflow obstruction usually is progressive and it is associated with a not normal inflammatory response of the lungs to particles or toxic gases inhalation, mainly caused by smoking (Diretrizes para o manejo da DPOC, 2016).

In gravity terms, by year, three million people die because of Chronic Obstructive Pulmonary Disease, that way, estimating an increase of mortality. From 1990 to 2010, COPD became the fourth cause of death, in Brazil it is the third cause of death between the not transmissible chronic diseases (Rabahi, 2013).

Between 2005 and 2010, occurred a 12% increase in the death number, what nowadays represent approximately 40.000 deaths by years (Rabahi, 2013).

Due to that, in 2011, the Unified Health System had a 103 million reais cost, regarding 142.635 hospitalizations because of COPD. This spending it was bigger than the cost with patients with acute myocardial infarction and that ones with hypertension, and approximately with the individuals with diabetes (Rabahi, 2013).

That way, in this context, the patient with Chronic Obstructive Pulmonary Disease may have significant reduce of effort tolerance due to many factors, and one of them it is the physical deconditioning associated with downtime (Rodrigues e collaborators, 2002).

Therefore, the intolerance to exercise it is common in patients with Chronic Obstructive Pulmonary Disease and this fact it was attributed exclusively to respiratory disturb shown by this individuals. However, has been verified currently that peripheral skeletal muscular dysfunction it is an important factor to effort tolerance decrease (Dourado and Godoy, 2004).

The 6-minutes walk test it is one of the most used tests in the world to effort submaximal capacity evaluation. It is a relatively simple test, with low cost and reflects the daily activities developed by individuals with Chronic Obstructive Pulmonary disease (Chetta and collaborators, 2006).

According to Maia and collaborators (2012), Nascimento, Lamonti and Jardim (2013), the Pulmonary Rehabilitation it is a comprehensive treatment and includes physical training, education of patient, oxygen therapy, psychosocial support and nutritional intervention.

The Pulmonary Rehabilitation (PR) it may be characterized as the multidisciplinary team intervention summation, which allows the satisfying restitution of clinical, physical, psychological and labor conditions (Brazilian Cardiology Society, 2005).

Consequently, the Pulmonary Rehabilitation has been demonstrated efficiency to improve dyspnea, the capacity of do exercise, the health and quality of life improvement.

The objective it was the functional capacity evaluation by the 6-minutes walk test and the Body Mass Index, in patients with Chronic Obstructive Pulmonary Disease participants of the Pulmonary Rehabilitation Program in the moments pre, in 18 sessions and in the end of 36 sessions.

MATERIALS AND METHODS

Ethical Considerations

The Research Ethics Committee in human beings approved the research protocol of the Federal University of Maranhão with number: 1.502.360.

Sample

The sample was composed by 20 patients with moderate Chronic Obstructive Pulmonary Disease (50% ≤ VEF1 <80% of predicted), being, 15 patients with this characteristic or grave (30% ≤ VEF1 <50% of predicted) being 5 patients, being them, 12 women and 8 men, clinically stables, without recent exacerbations and without any kind of cardiovascular or osteoarticular involvement.

The Chronic Obstructive Pulmonary Disease diagnosis was made, being these: Smoking; occupational dust; chemicals irritants; graves respiratory infections in the childhood and Alpha-1 antitrypsin deficiency. The average age in years of 62.85 ±12.39; average body mass in kilos of 61.31 ±11.72; average stature in centimeters of 1.60 ±0.07 and average BMI of 24.35 kg/m^2.

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Table 1 - Sample Characteristics.

Variables	Characteristics
Sex	8 men - 12 women
Age (years)	62.85 ± 12.39
Body Mass (kg)	61.31 ± 11.72
Stature (m)	1.60 ± 0.07
BMI (kg/m^2)	24.35 Appropriate

Procedures

- Rehabilitation Program Evaluation

During the physical evaluation, the patients answered the Clinical Interview Anamnesis/Questionnaire, contain: 1) identification data; 2) health and clinical history; 3) PAR-Q risk stratification questionnaire; (Rodrigues and collaborators, 1999; Heyward, 2004; ACSM, 2010; Garber and collaborators, 2011) and with finality of define the initial triage related to coronary disease risk factors.

The body mass (Kg) and stature (cm) measures were made with barefoot patients and with minimal clothes.

The body mass (Kg) was found with digital clinical balance (Filizola®) with 20 grams precision.

The stature (cm) founded by clinical scale coupled to the balance (Filizola®), with 0.5 centimeters precision.

- Training Protocols

The patients performed physical exercise in the Pulmonary Rehabilitation Center from HU-UFMA, following the assistance protocols already performed in the referred service, and selected by the same method that already happens today, or in other words, by the wait line.

Therefore, it is composed by combined exercises (aerobic and strength) by a period of 12 weeks, 3 times a week, making up 36 sessions, on alternate days, during 90 minutes by session; The loads were adjusted according to patients report from the dyspnea scale; It is worth remembering that all patients performed 36 training sessions.

The American College of Sport Medicine (2010) recommendations conducted the physical exercise program. This one recommends the beginning of training with large muscle groups stretching exercise in preparatory activities by five minutes. Moreover, in the end of session, decrease the effort adding a five minutes total.

The aerobic training was continuous type performed in a horizontal ergometric bicycle (Vision Fitness R2250®) or running machine (Matrix®) with a predetermined time varying from 20 to 30 minutes to execution.

The exercise intensity was prescribed according to VO_2 peak that showed in 6-minutes walk test (Bhambanhani, Singh, 1985; Zhang and collaborators, 2003; Stringer, Wasserman, 2005).

That way, the intensity control was performed by heart rate obtained during 6-minutes walk test. In the end of continuo aerobic exercise, the patient performed three minutes recuperation to, after, initiate the strength training.

This in turn, strength training was performed following the American College of Sport Medicine (2010) recommendations, whom recommended exercise to large muscle groups besides alternated by follow-up with training inspiratory musculature purpose.

The performed exercises were: resisted exercise of adduction-abduction horizontal of shoulder joint, resisted exercise of flexion-extension of shoulder joint, resisted exercise of anterior flexion associated to trunk rotation, resisted exercise of lateral trunk flexion, resisted exercise of lateral trunk rotation, upper limbs elevation above the head, final relaxing - profound inspiration and expiration, without others movements monitoring.

To lower limbs were performed hip flexion exercises. Furthermore, predict a load adding in strength training in every six training sessions, that, in this study was conducted according to Borg dyspnoea scale, whom must be referred from zero to ten, that way, the body mass adjusts were performed according to patient answers.

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- Procedures to data collection and equipments

To functional capacity evaluation, the patients were conducted to a corridor to 6-minutes walk test perform, which consist in measure of the meters walked number during six minutes, according to American Thoracic Society (ATS, 2002).

The patients were guided to walk a corridor with 30 meters length, of flat surface, leveled and without obstacles without oxygen supplementation, respecting peripheral saturation values of oxygen (SpO_2) initial bigger than 89%.

The stretch was demarcated on the ground with colourful ribbons and cones in both extremities. Before the beginning of the test, the patient was instructed about the procedures to performed, which consists in walk (not run) as fast as possible with no stop or reduce the march to accomplish the distance as big as possible in established time (American Thoracic Society, 2002).

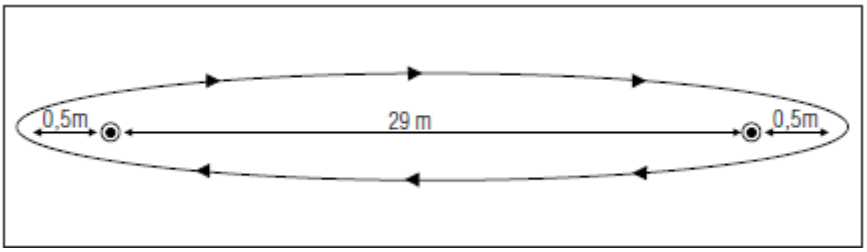

Figure 1 - Distance to be covered during the 6-minutes walk test. The cones show the dots which must occur the direction changes and they are positioned in a 0.5m distance of perimeters extremes to allow the patient to spin.

The collect was performed before the beginning of the program, 18 sessions and in the end of the 36 sessions program.

The Body Mass Index data were collected before the program and after its ending. The Body Mass Index (BMI) was obtained dividing the body mass in kilograms (Kg) by stature square in meters (m), according to Quetelet equation from 1871.

Statistics

The variables were tested about its distribution by Shapiro-Wilk test. The data are presented in mean and standard deviation. To demonstrate the statistical significance in variables of 6-minutes walk test and of body mass index were performed the ANOVA one-way for repeated measures and post-hoc test, Tukey to determinate the statistical difference in all analysis and significance level taken was $p<0.5$.

The clinical significance was performed with the size of effect by test Cohen D with 95% confidence coefficient, to 6-minutes walk test means. The software used to statistics analysis was Graphpad Prism 8.0.2 version.

RESULTS

Table 2 - Covered distance 6MWT and BMI.

Variables	Mean	SD	Maximum Value	Minimum value
6MWT (m) – pre	483.90	96.66	600.12	330.44
6MWT (m) – 18	572.34	94.33	632.34	412.72
6MWT (m) – 36	626.05	71.73	658.55	443.32
BMI (kg/m^2) – pre	24.35	4.89	33.00	17.00
BMI (kg/m^2) – 18	23.62	4.31	31.32	17.43
BMI (kg/m^2) – 36	22.83	4.07	29.70	16.89

Subtitles: 6MWT: 6-minutes' walk test; m: meters; SD: standard deviation; BMI: body mass index; kg/m^2: kilograms per meter square.

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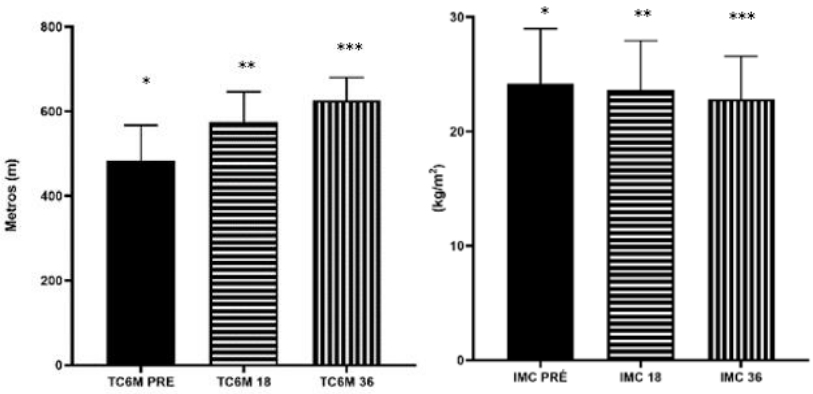

a) b)

Figure 2 a, b - Patients 6-minutes' walk test and BMI.

In table 2, are described the means and standard deviations and illustrated in figure 2 a, b, of covered distance results in 6-minutes' walk test and the Body Mass Index (BMI) results in pre moments, 18 session and in the end of rehabilitation program.

It was verified the significant increasement ($p<0.0001$) of covered distance by patients in 6MWT, in moments 18 sessions in relation to pre, in 88.44 meters (18.75%) and significant form ($p<0.0001$) in the end of 36 sessions in relation to pre, in 142.6 meters (29.46%), as well as also of significant form ($p>0.0001$) between the 36 sessions moment with the 18 sessions moment.

There were minimums values improvements in relation to covered distance in 82.32 meters (24.92%) compared to the pre moment. As well as there were minimums covered distance improvement at the 36 moment in relation to pre of 112.92 meters (34.18). It was also verified a better performance in minimums covered distance between 18 sessions moment and in the end of 36 session, in 30.6 meters (7.41%) and in maximum distance in 78.43 meters (13.7%). The D Cohen to the 6-minutes' walk test (6MWT) was 1.67, in the words, large treatment effect, with confidence interval of 0.652 – 2.687.

It was also verified a significant reduction ($p<0.0451$) of BMI in 0.73 kg/m^2, percent of 3% after 18 sessions. When compared to pre moments, and it has continued inn significant way ($p<0.0024$) of 1.52kg/m^2 with percent reduction of 6.24% when compared to 36 sessions moments with pre, and also significant way ($p<0.0024$) when we compare the 36 sessions moments with the 18 sessions moments.

DISCUSSION

In the current study, it was verified a significant performance ($p<0.0001$) in covered distance in 6-minutes' walk test. These results indicate that the patients had considerate improvement of functional capacity after the Pulmonary Rehabilitation Program. These data corroborate with found results by Moreira, Morais e Tannus (2005) in a group of 23 patients submitted to a pulmonary rehabilitation program, either 12 weeks duration in patients that receive strength training in lower and upper limbs and aerobic training.

In the Roceto and collaborators study (2007) is wasn't observed increase in covered distance in 6-minutes' walk test, in 34 patients after a rehabilitation program with 12 weeks duration, but the program had only one weekly session, in the current study, had 3 weekly sessions of 90 minutes each, by a 12 weeks period, given that in 18 sessions was already significant ($p>0.0001$) observing an improvement of 18.75%, as well as in 36 sessions remain significant ($p<0.0001$) being the improve of 29.47% from covered distance by patients in 6MWT.

Araújo and collaborators (2014) verified improvements in covered distance in 6-minute walk test in patients with COPD, after 24 pulmonary rehabilitation sessions, and in the same study evaluated the patients BMI, however it wasn't found difference in the body mass index after 24 sessions. In the current study, after 18 pulmonary rehabilitation sessions occurred already a significant reduce ($p<0.0451$) from 3% in BMI and also with 36 sessions this reduction was significant ($p<0.0024$) from 6.24% demonstrating the

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pulmonary rehabilitation program efficiency from this study.

It is worth mentioning that a possible explanation to improvement in covered distance in 6-minutes' walk test, it was the Body Mass Index reduction, what lead us to deduce that the patients reduced the fat mass and increased the muscle mass, what can reflect in a better performance in 6MWT.

It is worth mentioning that the assessment tool used to measure the functional capacity it was the 6-minutes' walk test, that have high prognosis accuracy, being capable of reflect the exercise capacity, the limitations in daily life activities, in addiction to be sensitive to changes provided by Pulmonary Rehabilitation (ATS, 2002).

Therefore, we can affirmed that the protocol proposed exercises to Pulmonary Rehabilitation used in this study presents as confinable in clinical routine application on measure that the D Cohen clinical test was of large effect since the treatment process with value of 1.67 with confidence interval of 0.652-2.687.

CONCLUSION

Starting from the found results, it can be affirmed that after a pulmonary rehabilitation program of 12 weeks with 36 sessions' duration with 90 minutes each aerobics exercises and strength combined occurred improvement in functional capacity of patients with Chronic Obstructive Pulmonary Disease, that can be observed in 18 and 36 sessions.

Moreover, in Body Mass Index, there was decrease after 18 sessions and maintenance after 36 sessions, therefore, with improvement in BMI of patients after the pulmonary rehabilitation program. That way, we recommend the present pulmonary rehabilitation program use in clinical treatment of patients with Chronic Obstructive Pulmonary Disease.

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Authors e-mail address:
paulocorreiamartins@gmail.com
deboraguimaraesfm@gmail.com
roger.medeiros.xavier@gmail.com
amcgarcia1@yahoo.com.br
matheusgcastro07@hotmail.com
cristiano.mostarda@gmail.com
ac-navarro@uol.com.br

Corresponding author:
Paulo Sergio Correia Martins
paulocorreiamartins@gmail.com
Rua nova, SN, residencial lago Verde I, BL 6, Apto 1.
Turu, São Luís, Maranhão.
CEP: 65066-350.

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