

## The Importance of the 6 Minute Walk test in the assessment of Romanian teenagers with cystic fibrosis

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### Abstract

*Introduction:* The measurement of lung function is the central part of the patients with cystic fibrosis assessment but we consider that exercise testing become an important tool in the continuous evaluation which is an indicative of prognosis and functional capacity and care of these patients. The 6 minute walk test is used to assess the individual's response to exercise. The aim of the study is to design an exercise training program, based on 6 minute walk test and to evaluate the effects of this complex protocol including incentive therapy, individualized supervised training program: swimming, trampoline, walking, jogging, aerobic gymnastic, cycling 3 times per week and airway clearance techniques. *Material and method:* We conducted a 6-month study, on 20 patients from the Romanian National Cystic Fibrosis Center, aged between 12 and 18. The inclusion criteria were: FEV1 or FVC lower than 60% of predicted, SpO2 lower than 94% at rest. *Results and discussions:* The initial assessment showed limitations of exercise due to poor skeletal muscle mass, pulmonary status and respiratory muscle strength. After combining airway clearance techniques, incentive therapy and individualized physical training, we observed improvements regarding pulmonary function, ease of breathing and significant increased of fitness (6 minutes walking distance increased from 518.2±108.9 meters to 604.9±68 meters). A positive correlation was observed between skeletal muscle mass and distance achieved to 6 minute walk test, at the end of the study. *Conclusion:* The proposed rehabilitation protocol of young cystic fibrosis patients is efficient and creates pleasure and joy during physiotherapy which enhanced the patient's adherence to the program.

**Key words:** 6 minute walk test, cystic fibrosis, pulmonary function, individualized supervised training program

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## Rezumat

**Introducere:** Evaluarea funcției pulmonare are un rol central în evaluarea pacienților cu mucoviscidoză, totodată testarea capacității fizice a acestora a devenit un important instrument de evaluare continuă cât și indicator în ceea ce privește capacitatea funcțională a acestor pacienți. Testul de mers 6 minute (6MM) este utilizat în obținerea informațiilor în ceea ce privește răspunsul individual la efortul fizic, este foarte accesibil și reflectă foarte bine capacitatea fizică în timpul activităților cotidiene. Scopul acestui studiu a fost de a crea pacienților cu mucoviscidoză un program de antrenament fizic bazat pe rezultatele obținute în urma aplicării testului de mers 6 minute și de a evalua efectele aplicării acestui protocol complex ce include: tehnici de clearance respirator, terapie incitativă și antrenament fizic individualizat și supervizat ce combină înotul, alergările ușoare, gimnastica aerobă, exercițiile pe bicicletă (de 3 ori pe săptămână). **Material și metodă:** Studiul s-a derulat pe un interval de 6 luni cu un număr de 20 de pacienți din cadrul Centrului Național de Mucoviscidoză cu vârsta cuprinsă între 12-18 ani. Criteriile de includere au fost: VEMS sau CVF sub 60 % și saturația de oxigen sub 94% în repaus. **Rezultate și discuții:** Evaluarea inițială a arătat o limitare a capacității fizice ca urmare a valorilor scăzute în ceea ce privește masa musculară scheletală, indicii ventilometrici cât și forța musculaturii inspiratorii. După aplicarea combinată a tehnicilor de clearance respirator, terapie incitativă și antrenament fizic individualizat am observat îmbunătățiri semnificative în ceea ce privește funcția pulmonară, ameliorarea respirației cât și creșterea nivelului de fitness (media distanței parcurse în 6 minute crescând de la 518.2±108.9 metri la 604.9±68 metri). Am observat de asemenea o corelație pozitivă între creșterea masei musculare scheletale și distanța de mers în timpul testului de mers 6 minute la finalul studiului. **Concluzii:** Protocolul individualizat de recuperare propus în cadrul studiului este eficient și oferă plăcere și entuziasm în timpul fizioterapiei crescând astfel aderența pacienților cu mucoviscidoză la programul de recuperare.

**Cuvinte cheie:** 6MTM, mucoviscidoză, funcție pulmonară, antrenament fizic individualizat

**Mențiuni:** Acest studiu s-a realizat cu suport financiar obținut de la UEFISCDI, TE/cod 36, Nr. Contract. 13/09.08.2010.

## Introduction

The measurement of lung function is the central part of the assessment of patients with cystic fibrosis (CF). Although many risk factors are important in the progression of CF, their relative impact over the time has been uncertain.

The formal cardiopulmonary exercise testing provides a global assessment of the exercise response, an objective determination of functional capacity and impairment, determination of the appropriate intensity needed to perform prolonged exercise, quantification of factors limiting exercise, and a definition of the underlying pathophysiologic mechanisms such as the contribution of different organ systems involved in exercise. (1)

The six-minute walk test (6MWT) does not determine the peak oxygen uptake, and diagnose the cause of dyspnea or exertion, but evaluates the individual's response to exercise. If it is associated with pulse oximetry it becomes an important test for evaluation of pulmonary patients. (1, 2). We consider that 6MWT becomes an important tool in the continuous evaluation, which is an indicative of prognosis and functional capacity of CF patients. The 6MWT is easy to carry out and reflects very well the activities of daily living. It also gives indication on adherence to exercise training/physical activity and measures the progress and response to treatment.

In an attempt to accommodate patients with respiratory disease for whom walking 12 minutes was too exhausting, a 6-minute walk was found to perform as well as the 12-minute walk (2). A recent review of functional walking tests concluded that “the 6MWT is easy to administer, better tolerated, and more reflective of activities of daily living than the other walk tests”. (3)

The aim of the study is to design an exercise training protocol, based on 6 MWT results, and to evaluate the effects of this complex protocol including incentive therapy, individualized and supervised training program and airway clearance techniques.

### Material and method

We conducted a 6-month study on 20 patients from the Romanian National Cystic Fibrosis Center, aged between 12 and 18. The inclusion criteria were: FEV1 or FVC lower than 60% of predicted, oxygen saturation of capillary blood (SaO<sub>2</sub>) lower than 94% at rest. The evaluation of CF patients consisted in body composition assessment (with the help of In-Body 720 multifrequency bioimpedance device) and distance achieved after performing the 6MWT at the beginning of the study and after 6 months. The 6MWT was performed indoor, on a long, flat, corridor with a hard surface that is seldom traveled following the American Thoracic Society recommendations. We gave instructions with standard explanations of test and patients were encouraged each minute during the test to „walk as far as possible”. The total distance achieved, breathlessness, heart rate and Sa O<sub>2</sub> pre- and post-test were measured. After the initial assessment all CF patients were included in a supervised rehabilitation program of 6 months consisted in combining individualized exercise training program, airway clearance techniques and incentive therapy. The rehabilitation program was conducted by two physical therapists under

supervision of a medical doctor and included: classic daily physiotherapy techniques of clearing (5 times a week - figure 1), individualized exercise training program (3 to 4 times a week - figure 2) and incentive therapy (3 times a week using TrainAir system - figure 3).

The Airway Clearance Techniques used during the rehabilitation program were: Active Cycle of Technical Breathing, Assisted Autogenic Drainage, Positive Expiratory Pressure, Bottle PEP, Flutter therapy, RC Cornet, Huff and coughing, High Chest Wall Oscillating and Modified Postural Drainage.

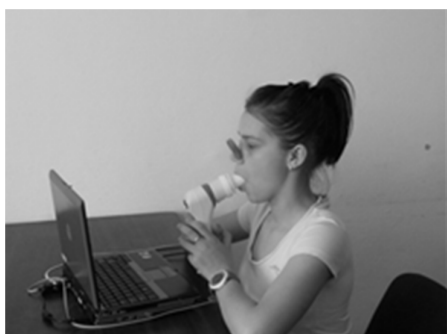


**Figure 1.** Individualized exercise training of CF patients from the study

TrainAir is the high-tech respiratory muscle training aid which can increase exercise capacity and give better breath strength. During a training session, the exercise will be repeated many times with the sustained maximum inspiratory pressure at 80% of maximum, with timed rest periods between exercises. The TrainAir mouthpiece provides the adjusted load for the workout.



**Figure 2.** Positive expiratory pressure with Flutter device



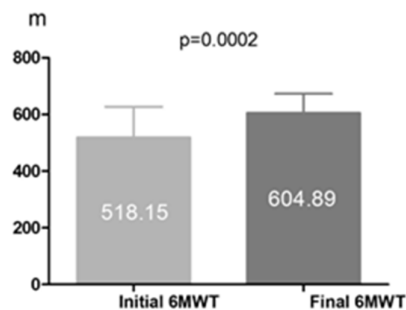
**Figure 3.** Incentive therapy using TrainAir computerised system

The flow generated when the CF patient inspire is accurately measured by the electronics in the handset and communicated to the PC. The software keeps track of the CF patient performance and ensures they are keeping to the training protocol, and therefore getting the maximum benefit from the exercises.

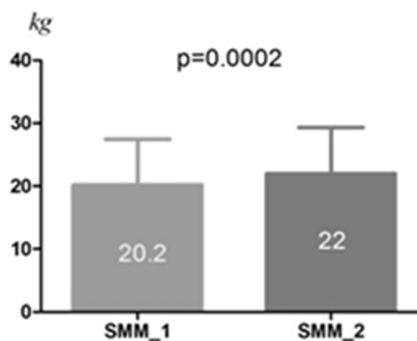
The physical therapists provided every CF patient an individualized exercise training program. We used chest mobility activities using movements around a vertical, sagittal and horizontal axis, shoulder mobility exercises-especially elevation and external rotation, muscle-strengthening activities. The physical therapists supervised each patient each patient and adjust the training program in order to be enjoyable age-appropriate and to create enhance the patients adherence to the program.

## Results and discussions

The initial assessment showed limitations of exercise due to poor skeletal muscle mass, pulmonary status and respiratory muscle strength. After performing the 6-month' rehabilitation program (combining airway clearance techniques, in-centive therapy and individualized exercise training) we observed significant improvements regarding pulmonary function, ease of breathing and increased fitness (6 minutes walking distance i-ncreased from  $518.2 \pm 108.9$  months to  $604.9 \pm 68.00$  months,  $p=0.0002$ ) and significant improve-ments of Skeletal muscle mass (it increased from  $20.23 \pm 7.226$ kg to  $22.03 \pm 7.277$ kg,  $p=0.0002$ ) (Figures 4 and 5).



**Figure 4.** 6MWT evolution after 6 months of intervention. The values are presented as mean with standard deviation. 6MWT: 6 minute walk test at baseline (Initial 6MWT) and after 6 months of rehabilitation (6MWT)



**Figure 5.** Skeletal muscle mass evolution after 6 months of intervention. The values are presented as mean with standard deviation. SMM: skeletal muscle mass at baseline (SMM\_1) and after 6 months of rehabilitation (SMM\_2)

A positive correlation was observed between skeletal muscle mass and distance achieved to 6 minute walk test, at the end of the study.

### Discussions

Physical training was gradually introduced as part of the CF care in the early 1980s, and the collective experience from centres using it shows beneficial effects (4, 5).

Simply recommending patients to be physically active is obviously not enough. They probably need more active guidance and continuing encouragement to become and remain physically active. Many research studies have shown that the distance that patients walk during the 6MWT is directly proportional to exercise tolerance of patient, lung function, and the feeling of breathlessness. It is well known that 6MWT can provide information about level of daily activity, well-being, and functional exercise tolerance necessary to perform daily activities but a good and properly assessment it is not enough without a modern and complex physiotherapy that is much wider concept than just airway clearance. Physical exercise is just as important as airway clearance therapy or incentive therapy, but the adherence is higher. The more satisfied the patient is with the treatment program the better the adherence. (6)

### Conclusions

The proposed rehabilitation protocol of young CF patients is efficient and creates pleasure and joy during physiotherapy which enhanced the patient's adherence to the program.

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