

Tanaffos (2005) 4(15), 33-36

©2005 NRITLD, National Research Institute of Tuberculosis and Lung Disease, Iran

Effect of Nutrition on Inspiratory Muscles and FEV1 in Patients with Emphysema

Behzad Banieghbal, Parisa Adimi, Majid Malek Mohammad, Mohammad Reza Masjedi

Department of Pulmonary Medicine, NRITLD, Shaheed Beheshti University of Medical Sciences and Health Services, TEHRAN-IRAN.

ABSTRACT

Background: Malnutrition is an effective factor in respiratory muscles dysfunction in patients with chronic obstructive pulmonary disease (COPD). The present study was performed to evaluate the effect of improved nutrition on inspiratory muscles in patients with advanced COPD.

Materials and Methods: Total of 33 patients suffering from emphysema were studied during a 3-year period using a quasi experimental (before- after study) method. All of them had forced expiratory volume in one second (FEV1) <30% and had received Atrovent, Salmeterol, Becotide (in maximum doses) and oxygen therapy for at least one year. Initially, FEV1 and airways resistance of patients were measured using body plethysmography. After a 35 Kcal/kg diet including 20-40% fat, 40% protein and 20% carbohydrates, these patients were followed by monthly scheduled visits. Spirometric parameters were measured again 3 and 6 months later and the results were analyzed using Freedman method.

Results: Pulmonary function tests of the under study patients at the beginning, 3 and 6 months later were as follows respectively; FEV1; 18.3%, 19.57%, 20.95%, airways resistance; 65.3%, 63.7%, 64.9% and maximal inspiratory pressure (MIP); 2.59, 3.062 and 3.29 cmH₂O. There was a significant difference in FEV1 and MIP of patients in 3 and 6 months period ($P<0.05$). Meanwhile, there was no significant difference in airways resistance of patients ($P=0.08$).

Conclusion: Improved nutrition results in increased MIP and FEV1 without changing in other indices (i.e. constant airways resistance indicates constant treatment status of the patient). Thus, an appropriate nutritional diet including sufficient calorie with small frequent meals at least for six months can increase FEV1 by reinforcing inspiratory muscles resulting in improved pulmonary function. (*Tanaffos* 2005; 4(15): 33-36)

Key words: Nutrition, Malnutrition, Emphysema, Inspiratory muscles, COPD

INTRODUCTION

In patients with advanced emphysema, who have developed serious respiratory problems, decreased

respiratory muscles strength is one of the most important factors in causing severe respiratory dysfunction (1, 2, 3).

Thirty to seventy percent of COPD patients have significant symptoms of malnutrition (1,4). Malnutrition, accompanied by weight loss, causes

Correspondence to: Banieghbal B

Address: NRITLD, Shaheed Bahonar Ave, Darabad, TEHRAN 19569, P.O.:19575/154, IRAN

Email address: behzad_bani8@yahoo.com

muscles dysfunction resulting in decreased patient's tolerance during exercise and respiratory activities (2). This decrease in lean body mass is due to alteration in body metabolism, decreased calorie intake, aging, no exercise, tissue hypoxia, inflammation, and drugs (5, 6, 7, 8). The reason for increased basal metabolism in COPD patients is increased respiratory activity in these patients, although the appetite is decreased as the result of inflammatory system activity (9, 10, 7). On the other hand, dyspnea is aggravated after meal in these patients; therefore, they have a phobia about foods which will eventually result in citophobia (11).

Malnutrition is usually associated with decreased respiratory muscles mass especially in diaphragm which is more injured in patients with emphysema rather than those with chronic bronchitis.

In addition, to reach stable mechanical status of respiration, regular exercise, improved oxygenation, correction of anemia and heart failure should be performed to improve general condition and respiratory status as well as increase appetite of patients with advanced pulmonary diseases. Furthermore, these procedures can decrease the sputum and dyspnea and improve nutritional status and diaphragm position (12). The recommended regimen should contain 20-40% fat especially vegetable shortening, 20% carbohydrate and 40% protein (3, 6, 11).

In this study, we evaluated respiratory function (including inspiratory muscles) of patients with emphysema by obtaining related tests and assessed the effect of improved nutrition on these items.

MATERIALS AND METHODS

Patients with emphysema, who had referred to department of pulmonary medicine and had a 1-year follow up record, entered the study between 2000 and 2003. A semi-experimental case- control study was performed and diagnosis was made based on

history, chest x-ray, high resolution computed tomography (HRCT), diffusing capacity of carbon monoxide (DLCO) and pulmonary function test (PFT). Additionally, total lung capacity (TLC), FEV1, FEV1/ FVC and inspiratory muscle strength (PI max) (cm H₂O) were measured in patients using body plethysmography. Also, all of them underwent echocardiography and complete blood count (CBC) test was obtained. 35 kcal/kg regimen including 20-40% unsaturated fat, 40% protein and 20% carbohydrate was prepared.

Exclusion and inclusion criteria:

Patient who had FEV1<30%, FEV1/FVC<70% and DLCO/VA<50%, were included. Furthermore, all of them were smokers using more than 20 packs/year. Body mass index (BMI) <23 was considered as inappropriate nutrition.

All patients with COPD aggravating factors such as anemia, heart failure, neoplasm, infection and pneumothorax were initially excluded or entered the study after treatment. All patients underwent treatment with oxygen, bronchodilators and inhaled steroids for at least one year. Patients having history of using levothyroxin or appetite stimulating drugs were excluded. FEV1, MIP and resistance parameters were recorded initially, 3 and 6 months later.

Statistical Analysis

All the above-mentioned variables had normal distribution with mean \pm SD. To compare these variables in three different phases and evaluating the interventions, Freedman test was used. Data were analyzed using SPSS software. As a whole, 33 patients who had a one- year follow-up along with other inclusion criteria were selected sequentially.

RESULTS

Out of 33 patients under the study, 29 (87.9%) were male and 4 (12.1%) were female with mean \pm SD age of 69.8 (\pm 8.4), mean (\pm SD) weight of 59.33 (\pm 7.4), and BMI=19.3 \pm 2.

As shown in table 1, the mean evaluation of

pulmonary function tests initially, 3 and 6 months later, were as follows: FEV1=18.3±3.2, 19.57±2.8 and 20.95±3.4, respectively; resistance of airways RAW= %653.94±146, % 637.73±119% and %649±123%, respectively; and MIP=2.59± 0.6, 3.062± 0.6 and 3.29±0.6, respectively. As shown in Figure 1, a statistically significant difference in FEV1 measurement was observed 6 months after the beginning of study (P<0.05). This was also true about MIP (3 and 6 months later; P<0.05) but there was no significant difference in airways resistance initially and after a 6-month period (Figures 2 and 3).

Table 1. Evaluation of parameters at 0, 3 and 6 months.

	Min	Max	Mean	Std. Deviation	P-value
P.Y	20	60	37.93	10.20	
B.W	44	75	59.33	7.49	
FEV1-1	12	24	18.33	3.22	0.000
FEV1-2	15	27	19.57	2.82	
FEV1-3	14	28	20.95	3.41	
RAW-1	420	1050	653.94	146.93	0.08
RAW-2	440	940	637.73	119.54	
RAW-3	450	880	649.70	10.20	
MIP-1	1.45	4.10	2.5985	7.49	0.000
MIP-2	1.50	4.70	3.0621	3.22	
MIP-3	2.20	4.40	3.2909	2.82	

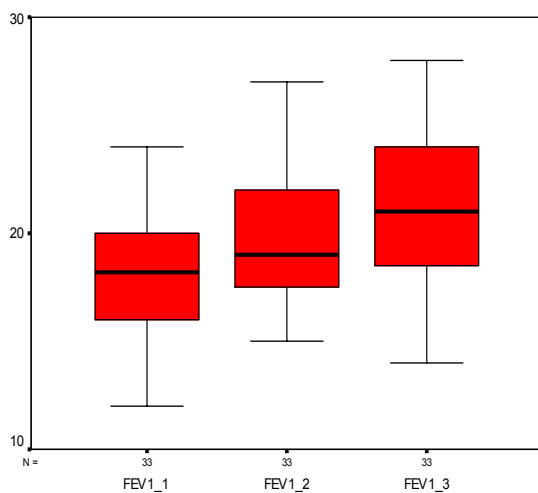


Figure 1. FEV1 at 0, 3, and 6 months.

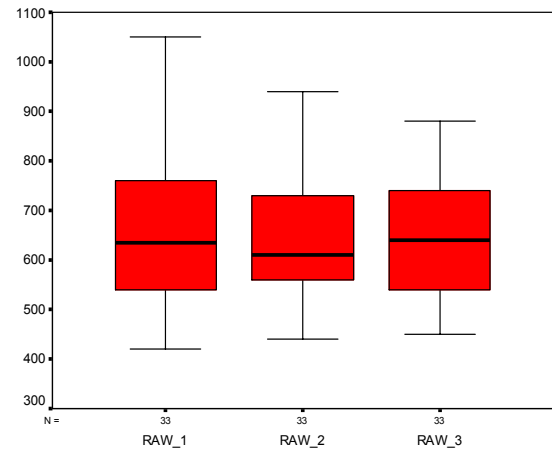


Figure 2. RAW at 0, 3, and 6 months.

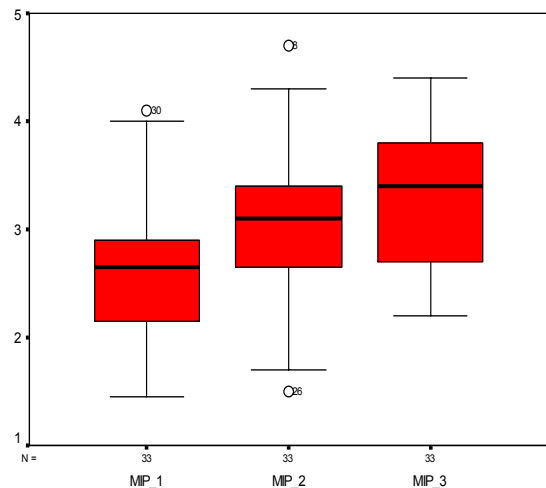


Figure 3. MIP at 0, 3, and 6 months.

DISCUSSION

All study patients had FEV1<30% and underwent oxygen therapy, physiotherapy and bronchodilators; additionally, those with COPD aggravating factors were detected and excluded. Thus, the included patients had low FEV1 in spite of appropriate drug therapy. It seems that changing the nutritional state of study patients caused a significant difference in inspiratory muscles strength (measured as MIP) (P<0.05). Additionally, alteration in MIP was accompanied with significant FEV1 changes (despite

no sensible alteration in airways resistance).

Proper nutrition can play a role as an independent factor in patients who receive oxygen (maximum level) and drugs. It can improve immune system and reduce infection frequency by reinforcing respiratory muscles especially diaphragm (13, 14, 15). As a result, we recommend that adequate calorie (including unsaturated fat 20-40%, carbohydrate 20% and protein 40%) in small and frequent meals must be used in advanced COPD patients. Furthermore, it is recommended to use vegetable oils, particularly olive oil, and oily seeds in daily patient's diet accompanied with all essential vitamins.

REFERENCES

1. Donahoe MP. Nutrition in end-stage pulmonary disease. *Monaldi Arch Chest Dis* 1995; 50 (1): 47- 50.
2. Rochester DF. Malnutrition and the respiratory muscles. *Clin Chest Med* 1986; 7 (1): 91- 9.
3. Ferreira IM, Brooks D, Lacasse Y, Goldstein RS. Nutritional support for individuals with COPD: a meta-analysis. *Chest* 2000; 117 (3): 672- 8.
4. Cano NJ, Roth H, Court-Ortune I, Cynober L, Gerard-Boncompain M, Cuvelier A, Laaban JP, Melchior JC, Pichard C, Raphael JC, Pison CM; Clinical Research Group of the Societe Francophone de Nutrition Enterale et Parenterale. Nutritional depletion in patients on long-term oxygen therapy and/or home mechanical ventilation. *Eur Respir J* 2002; 20 (1): 30- 7.
5. Wilson DO, Rogers RM, Wright EC, Anthonisen NR. Body weight in chronic obstructive pulmonary disease. The National Institutes of Health Intermittent Positive-Pressure Breathing Trial. *Am Rev Respir Dis* 1989; 139 (6): 1435- 8.
6. Schols AM, Soeters PB, Dingemans AM, Mostert R, Frantzen PJ, Wouters EF. Prevalence and characteristics of nutritional depletion in patients with stable COPD eligible for pulmonary rehabilitation. *Am Rev Respir Dis* 1993; 147 (5): 1151- 6.
7. Schols AM, Wouters EF. Nutritional abnormalities and supplementation in chronic obstructive pulmonary disease. *Clin Chest Med* 2000; 21 (4): 753- 62.
8. Decramer M, Lacquet LM, Fagard R, Rogiers P. Corticosteroids contribute to muscle weakness in chronic airflow obstruction. *Am J Respir Crit Care Med* 1994; 150 (1): 11- 6.
9. Schols AM, Creutzberg EC, Buurman WA, Campfield LA, Saris WH, Wouters EF. Plasma leptin is related to proinflammatory status and dietary intake in patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1999; 160 (4): 1220- 6.
10. Wilson DO, Rogers RM, Sanders MH, Pennock BE, Reilly JJ. Nutritional intervention in malnourished patients with emphysema. *Am Rev Respir Dis* 1986; 134 (4): 672- 7.
11. Lisa M Bellini, Nutritional support in advance lung disease. In up to date 12.1. Available form: <http://www.uptodate.com>.
12. Manaker S, Burke F. pulmonary disease. In: Medical Nutrition and disase, Morrison G, Harklle L, (Eds), black well science, Boston, 1996, p. 279.
13. Chailleux E, Laaban JP, Veale D. Prognostic value of nutritional depletion in patients with COPD treated by long-term oxygen therapy: data from the ANTADIR observatory. *Chest* 2003; 123 (5): 1460- 6.
14. Hamilton AL, Killian KJ, Summers E, Jones NL. Muscle strength, symptom intensity, and exercise capacity in patients with cardiorespiratory disorders. *Am J Respir Crit Care Med* 1995; 152 (6 Pt 1): 2021- 31.
15. McMurray DN, Loomis SA, Casazza LJ, Rey H, Miranda R. Development of impaired cell-mediated immunity in mild and moderate malnutrition. *Am J Clin Nutr* 1981; 34 (1): 68- 77.