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Original Article

Effects Of Pulmonary Rehabilitation On Body Mass Index In Patients With Copd.

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Abstract :

Background : COPD is preventable, as well as treatable disease with some important extra pulmonary effects which may contribute to the severity of this disease. Pulmonary rehabilitation (PR) is known to be beneficial treatment for COPD patients.

Objective : To evaluate the effects of pulmonary rehabilitation on anthropometry in male patients with moderate stable COPD.

Methods : This prospective study was conducted in the Department of Physiology, BSMMU, Dhaka from 1st July 2010 to 30th June 2011 on 116 male stable moderate COPD patients aged 50 to 65 years. They were enrolled from the OPD of the Department of Medicine of BSMMU and NIDCH Dhaka. All the patients were grouped as control (56 patients without rehabilitation) and experimental (60 patients with rehabilitation). Pulmonary Rehabilitation (PR) program includes breathing exercises (pursed lip breathing and diaphragmatic breathing) and lower extremity endurance training (ground based walking); and was advised to the experimental patients to perform for 30 minutes duration per session at home twice daily, for consecutive 60 (Sixty) days along with the standard drug treatment of COPD. On the contrary, the control patients were advised to continue their standard drug treatment alone for consecutive 60 days. Anthropometry was assessed by measuring the BMI. Study variable was assessed on day 0 and day 60 for both the groups and the statistical analysis was done by independent sample 't' test and paired Student's 't' test. In the interpretation of results, $p \leq 0.05$ was accepted, as level of significance.

Results : BMI was significantly increased in comparison to the control patients after 60 days of follow up.

Conclusion : The study reveals improvement of BMI with this sort of combination of PR program in stable COPD patients.

Key words : Pulmonary rehabilitation, COPD, BMI.

Introduction :

Chronic Obstructive Pulmonary Disease (COPD) is one of the major causes of chronic morbidity and mortality throughout the world [1]. Many people suffer from the disease for years and die too early from its complications. It is the fourth leading cause of death in adults of United States and also projected to be the third by 2020[2]. According to Global Initiative for Chronic Obstructive Lung Disease (2008), COPD is a preventable and treatable disease[1]. However, once developed this disease along with its comorbidities can not be cured, though its progression and morbidity can be reduced[1].

The pulmonary component of COPD is characterized by airflow limitation which is not fully reversible and usually progressive[1]. Chronic airflow limitation in COPD is caused by

a mixture of small airways disease (obstructive bronchiolitis) and parenchymal destruction (emphysema) the relative contributions of which vary from person to person[1].

Pulmonary rehabilitation (PR) is an evidence-based, multidisciplinary and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased daily life activities[3]. Integrated into the individualized treatment of the patient, PR has been designed to reduce symptoms, optimize functional status, increase participation and reduce health care costs through stabilizing or reversing systemic manifestation of the disease[3]. According to GOLD (2008), principal goals of PR are to reduce the symptoms, to improve quality of life, and to increase the physical and emotional participation in everyday activities[1]. To accomplish these goals, pulmonary rehabilitation covers a range of non-pulmonary problems that may not be adequately addressed by medical therapy for COPD. The minimum length of an effective rehabilitation program has been suggested as 6 (six) weeks, though longer would the program, more effective would be the results[1]. COPD itself has various extrapulmonary (systemic) effects which may lead to different comorbid conditions[4]. Weight loss, nutritional abnormalities and skeletal muscle dysfunction are well-recognized extrapulmonary effects of COPD[5].

BMI is defined as weight in kilograms and height in square meters[6]. It is widely accepted that COPD is accompanied by weight loss[7]. Weight loss and a low body weight are associated with increased morbidity and a poor diagnosis for COPD patients[8]. According to Gray- Donald and co-workers (1996) body mass index (BMI) is a strong predictor of mortality[9]. Barrends and co-workers (1997) indicated that BMI is not sensitive to changes in muscle mass and therefore not suitable for mortality prediction or indication of exercise capacity[10]. Weight loss in COPD patients can be attributed to the loss of muscle mass and not fat, as in the case of starvation[11]. Due to the increased energy requirements of the respiratory muscles, COPD patients have increased resting energy requirements[12]. Weight loss is one of the major presentation of COPD patients[7].

The prevalence of weight loss in patients with severe COPD and chronic respiratory failure, occurring in 50% of these patients, but can be seen also in 10-15% of patients with mild to moderate disease[13]. They also stated that, Loss of skeletal muscle mass is the main cause of weight loss in COPD, whereas loss of fat mass contributes to a lesser extent. MacNee (2007) stated that, although weight loss is generally accompanied by a significant loss in fat free mass (FFM), muscle wasting may occur even in weight-stable COPD patients[6].

In different prospective studies abroad improvement in BMI were found by different investigators in patients with stable COPD both before and after administration of different component of PR program such as breathing strategies and lower extremity endurance training[14-16]. Different investigators observed that PR program (such as breathing strategies and lower extremity exercise) for 9 weeks[14], for 12 weeks[15] and for 1year and for 3 years[16] resulted in significant improvement of BMI.

However, with the best of our knowledge no study has yet been done in Bangladesh to observe the effects of combination of more than one component of PR program on BMI in stable COPD patients. Therefore, on the basis of this background, the present study has been designed to evaluate the effects of PR program such as breathing exercises (pursed lip breathing and diaphragmatic breathing) and lower extremity endurance training (ground based walking) on BMI in male patients with moderate stable COPD.

Methods :

This prospective experimental study was carried out in the Department of Physiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka from July 2010 to June 2011. A total number of 116 male stable (without any exacerbation for last 4 weeks[17]) moderate COPD (Postbronchodilator FEV_1/ FVC < 0.70 and FEV_1 < 80% but ≥ 50% of predicted[1]) patients age ranged from a 50 to 65 years were selected from the Medicine Out Patient Department (Respiratory Wing) of BSMMU and the Department of Medicine of National Institute of Diseases of the Chest and Hospital (NIDCH), Mohakhali, Dhaka by systematic random sampling. Out of this, 56 COPD patients were not given PR program and act as control group (Group A), 60 patients were given PR program and act as study group (Group B) and designated as A_1 and B_1 (On day 0) and A_2 and B_2 (On day 60), respectively. The study protocol was approved by Ethical Review Committee (ERC) of BSMMU. COPD patients of both group were similar in terms of age, height, duration of COPD, duration of smoking, socioeconomic status and occupation. Subjects with H/O bronchial asthma, bronchiectasis, respiratory failure, pneumothorax, pleural effusion, pulmonary tuberculosis, pulmonary fibrosis, pneumonectomy or pulmonary lobectomy etc[18] any cardiovascular diseases[18], diabetes mellitus (Fasting plasma glucose >7 mmol/dl[19]), SLE[20], systemic hypertension (SBP ≥

140 and DBP ≥ 90 mm of Hg[21]), any malignancy or renal disease (Serum creatinine >1.36 mg/dl[22]), were excluded from the study. PR program included breathing exercises (pursed lip breathing and diaphragmatic breathing) and lower extremity endurance training (ground based walking) for 30 minutes duration per session and were performed at home twice daily, for consecutive 60 (Sixty) days along with the standard drug treatment of COPD. In the technique of pursed lip breathing, patients inhaled through the nose with mouth closed, and then exhaled through mouth with lips pursed tightly[6]. The exhalation was twice as long as the inhalation. In the technique of diaphragmatic breathing, the patients were asked to exhale slowly through pursed lips while drawing the abdomen inward, and inhale slowly through the nose so that the abdomen would expand outward[6]. In the technique of LEET, subjects was asked to walk at home or on a flat track as much as he can with a submaximal speed twice a day. During walking, he was used pursed lip breathing[23].

After selection, all the patients were thoroughly informed about the aim, objectives and procedure of the study and were encouraged for their voluntary participation. Then an informed written consent was taken from each subject. A detail personal, medical, family, socioeconomic, occupational and drug history were recorded in a preformed questionnaire and thorough physical examinations were done and documented. Anthropometry was assessed by measuring the BMI. BMI was measured in both the groups, on the first day of the study and also at 60th days. Data were expressed as mean ± SD of percentage of the predicted value (% PV) and were statistically analyzed by SPSS (Version 16.0) using Chi-square test, independent sample 't' test and paired student's 't' test, as applicable. In the interpretation of results, $p \leq 0.05$ was accepted, as level of significance.

Results :

Sociodemographic characteristics of different groups as shown in Table I.

After 60 days follow up, BMI was significantly increased in the rehabilitated patients than that of their state of pre-rehabilitation (Table II).

In addition, BMI was higher in the group with rehabilitation after 60 days of PR program, in comparison to that of the group without rehabilitation though the difference was not statistically significant (Table II).

On the other hand, BMI was significantly decreased after 60 days follow up in the COPD patients without rehabilitation (Table II).

Table I

Sociodemographic characteristics of different groups (n=116)

Parameters	Group A (n=56)	B (n=60)	P value
Age (years)	58.91±4.05 (50-65)	58.58±4.12 (50-65)	0.667 ^{ns}
Height (meters)	1.655±0.03 (1.58-1.72)	1.651±0.03 (1.57-1.71)	0.458 ^{ns}
Duration of COPD (years)	3.04±1.12 (0.5-5)	3.41±1.22 (1-5)	0.090 ^{ns}
Duration of smoking (pack years)	15.41±4.16 (11-25)	16.80±4.38 (11-25)	0.075 ^{ns}
Socioeconomic statue (score)	1.63±0.78 (1-4)	1.88±0.83 (1-4)	0.298 ^{ns}
Occupation (score)	2.04±1.06 (1-4)	2.37±1.06 (1-4)	0.232 ^{ns}

Data were expressed as mean±SD. Figures in parentheses indicate ranges

a = independent sample 't' test, b= Chi-square test (χ^2), applicable for A vs B.

Group A	:	Stable COPD patients without PR (control)
Group B	:	Stable COPD patients with PR (experimental)
n	=	number of subjects
ns	=	non significant

Table II

BMI in different groups in different duration (n=116)

Groups	Measurement on different duration	BMI (kg/m^2)
A	A_1 (on day 0)	21.08±1.13 (18.56-22.84)
(n=56)	A_2 (on day 60)	20.94±0.99 (18.91-22.43)
B	B_1 (on day 0)	20.69±1.09 (18.69-22.68)
(n=60)	B_2 (on day 60)	20.96±1.14 (18.65-23.34)

Statistical analysis

Groups		p value
A_1 vs B_1 [a]		0.063 [ns]
A_2 vs B_2 [a]		0.941 [ns]
A_1 vs A_2 [b]		0.002**
B_1 vs B_2 [b]		0.000***

Data were expressed as mean±SD. Figures in parentheses indicate ranges.		
a = independent sample 't' test, b = paired student's 't' test.		
Group A	:	Stable COPD patients without PR (control)
Group B	:	Stable COPD patients with PR (experimental)
***	=	significant ($p \leq 0.001$)
**	=	significant ($p \leq 0.01$)
ns	=	non significant
n	=	number of subjects

Discussion :

The present study was undertaken to observe the effects of home based pulmonary rehabilitation on anthropometry in COPD. For this, male stable patients with moderate COPD were studied and their anthropometry were assessed by measuring BMI, which was measured both before and after receiving a home based PR program such as breathing exercises (pursed lip breathing and diaphragmatic breathing) and lower extremity endurance training (ground based walking) for 60 consecutive days and also without PR. In the present study, both the groups (with and without PR) were comparable, as their differences in age, height, duration of COPD, duration of smoking, socioeconomic status and occupation were statistically non significant, at their state of prerehabilitation. Again, the study variable in all the patients, were almost similar to those reported by several investigators of different countries abroad, at their state of prerehabilitation[14-16]. In the present study, after 60 days with rehabilitation, this variable was significantly increased in the rehabilitated patients than that of their state of prerehabilitation. However, similar improvement of this variable had been reported after 9 weeks[14], after 3 months[15] and after 1 year and 3 years[16] of PR program.

Different investigators of different countries have been suggested that decrement in skeletal muscle mass due to decreased protein synthesis[24], increased accessory respiratory muscle work load[25] and disuse atrophy in the peripheral limb muscles[26] may cause decrease BMI in this group of debilitated patients[27]. However, Schols et al. (1993) suggested that 85% of the stable moderate COPD patients may present with BMI within physiological range[13].

In addition, it has been reported that regular LEET may cause increased capillarization of the less used peripheral as well as respiratory skeletal muscles followed by increased tissue oxygenation and protein synthesis of them[23]. As a consequence, there may be a great increment in muscle mass which may be the cause of significant improvement in BMI of the experimental patients in this study[23].

Conclusion :

From this study, it may be concluded that BMI were improve after PR program in male patients with moderate stable COPD.

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