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Effect of Slow Breathing Exercise on Forced Vital Capacity and Forced Expiratory Volume in Patients with Major Depressive Disorder

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Abstract

Background: Major Depressive Disorder (MDD) is associated with depressed lung function. Regular practice of slow breathing exercise (SBE) significantly improved lung function in healthy adult subjects. This study aimed to observe the effect of SBE and anti-depressive medication on forced vital capacity (FVC), forced expiratory volume in 1st second (FEV_1) and FEV_1/FVC% in major depressive disorder.

Methods: This prospective intervention study was carried out in the Department of Physiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka on 60 newly diagnosed MDD female patients aged 20 to 50 years. They were enrolled from the Department of Psychiatry of BSMMU. Age, body mass index (BMI), socioeconomic status and occupation matched 30 apparently healthy females were controls. MDD patients were subdivided into 2 groups. Thirty (30) patients were intervened with slow breathing exercise (SBE) along with anti-depressive medication whereas 30 patients were under anti-depressive medication only. All patients were studied at baseline and at the end of 3 months of intervention. FVC, FEV_1 and FEV_1/FVC% were assessed by a portable digital spirometer. To see the difference independent sample 't' test and paired sample 't'test were used as appropriate.

Results: FVC, FEV_1, FEV_1/FVC% were significantly lower ($p \leq 0.001$) in all MDD patients at baseline than control. After 3 months of follow-up these values were found significantly improved in patients with slow breathing but no improvement was found in patients treated with only anti-depressive medication. Moreover, these values were found significantly higher in patients with SBE than those of patients under medication only after 3 months of follow-up.

Conclusion: Based on the study findings, it may be concluded that SBE may significantly improve depressed lung function of MDD patients whereas anti-depressive medication had no impact on reduced lung function associated with MDD.

Keywords: Forced Vital Capacity, Slow breathing exercise, MDD

Introduction

Depression is a major cause of worldwide morbidity. The WHO ranks depression as the fourth leading cause of disability worldwide, but by 2020, it will be the second leading cause.[1] Population studies have consistently shown major depression is about twice as common in women as in men, although the cause and factor is unclear.[1] All the organs and systems of the body may be affected by depression and it is an important risk factor for development of various diseases including, myocardial infarction, other coronary artery diseases, stroke, diabetes mellitus, kidney diseases, arthritis, and many other autoimmune diseases.[2]

Among the functional systems of human body, respiratory system also has been found affected by depression. Reports of several studies showed that Depression and poor lung function are closely associated. Depressed chronic obstructive pulmonary disease (COPD) patients had greater loss of functions, decreased effect of therapeutic

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interventions and poor self-management.[3] Previous studies reported depressed lung function in depressive illness including major depressive disorder (MDD). They found FVC, FEV_1 and FVC/ FEV_1 were significantly lower in MDD patients in comparison to healthy subjects.[4-5] In clinical practice, symptoms of MDD may be relieved by anti-depressive medication or other support but the depressed lung function still remains for health concern for these patients. Many traditional measures are often attempted for achieving good health and well being in daily life. These measures range from use of herbal medicine to practice of yoga based relaxation technique. For improvement of cardiorespiratory function, practice of yoga based various relaxation technique is very common in general population.[6-7] Among various techniques of yoga, controlled breathing exercise for improvement of respiratory function is widely used.[8-10] Alternate nostril breathing is a maneuver of slow and deep breathing exercise which is a yoga based relaxation technique and it has currently earned vast popularity among healthy conscious people.[10] In yogic literature, it is also known as Anuloma Viloma. The good impact of this method on various psychological disorder as well as pathological diseases has been recognized.[11] Several previous investigations found significant improvement in FVC, FEV_1, PEFR following a short period of slow breathing exercise in healthy volunteers.[9,12-14] Different studies investigated and found positive role of yoga in relieving depression symptoms.[15]

Very recently poor lung function associated with depression has been highlighted as important research focus. Very few works have been done on this important organic poor function due to depression. One study reported significantly deteriorated spirometry in depressed patient in absence of lung pathology.[4] Clinician's attention usually focus depressive symptoms and these patients are commonly treated with anti-depressive medication and counselling. The problem of poor lung function in these patients often remains ignored due to lack of information. But in addition to relieve depressive symptoms,to look for a way out to improve the lung function in these patients is no less important. SBE is well recognized, cost free, easy, comfortable nonpharmacological effective approach to improve lung function. Though there is accumulation of evidence in favor of improvement of lung functions by SBE in healthy adults but the potential of this technique to improve the strength of the lung ventilation in depressed patients so far has not been investigated.

Therefore, the study was aimed to explore the effect of SBE on lung function status and also to observe the influence of anti-depressive drugs on lung function by assessing some spirometric measures FVC, FEV_1 and FEV_1/FVC% in MDD patients.

Materials and Methods

This prospective intervention study was conducted in the Department of Physiology, BSMMU, Dhaka, during 2014. For this study, 60 newly diagnosed female drug naive MDD patients aged 20 to 50 years (Group B) were selected from the Out-Patient Department of Psychiatry of BSMMU, Dhaka. According to DSM IV criteria, diagnosis was done by the attending Psychiatrist.[7] Thirty (30) apparently healthy female subjects with similar age, BMI, socioeconomic status were selected as control (Group A). All procedures of this study including ethical aspects was reviewed and approved by Institutional Review Board of the BSMMU. The study subjects were free from pregnancy, lactation, history of lung diseases, coronary heart disease, diabetes mellitus, neurological disorders, and any other comorbid psychiatric illness. The newly diagnosed MDD patients (Group B) was further subdivided into two groups according to the design and type of intervention given. Intervention was given with SBE for consecutive 3 months. Group B1 included 30 MDD patients who received only anti-depressive medication and did not perform slow breathing exercise. Thirty patients who performed SBE as well as received anti-depressive medication were included in Group B2. Both patients groups were studied at baseline (pre intervention) and after 3months of follow-up (post intervention). According to the period of data collection, these groups were further designated as $B1_a$ and $B2_a$ (pre-intervention) and $B1_b$ and $B2_b$ (post-intervention). Data of control group (Group A) was collected once and they were not provided intervention.

Spirometric measures including FVC,FEV_1 and FEV_1/ FVC% were compared between the control and newly diagnosed MDD patients at baseline (Group Avs Group $B1_a$ & $B2_a$) as well as between pre and post intervention period (Group $B1_a$ vs $B1_b$; Group $B2_a$ vs Group $B2_b$) to observe the effect of intervention and also between two post intervention group ($B1_b$ vs $B2_{b)}$ to observe the effect of slow breathing exercise exclusively. After selection, the aim, objectives, benefits of this study were explained to each subject and encouraged for voluntary participation and informed written consent was taken from each subject. Then the benefit of slow breathing exercise and its useful effect on lung function as well as the effect on depression itself was explained to the patient and also their accompanying relatives. In addition, the steps of SBE in detail, the time period and environment of practice was taught. Special emphasis was given to ensure the regular practice of this exercise by the patients. For this, relatives were adequately informed to monitor and ensure it. For maximum compliance, a special training session for the patients to learn slow breathing exercise was arranged by the researcher for 2-3 days. The subjects were under regular contact and continuous monitoring through telephone and occasionally by visiting home. They were also asked questions to make sure whether the exercise was practiced properly. A detail personal, medical, family, socioeconomic, occupational and drug history were recorded and thorough physical examinations were done. All information including socio demographic data were documented in a data schedule. For assessing lung function FVC, FEV_1 and FEV_1/FVC% of all subjects were recorded by a digital spirometer (PONY FX, Cosmed, Italy) with a bronchodilator reversibility test. Both groups of patients were advised to report to the pulmonary function lab of department of Physiology of BSMMU after 3 months for follow-up lung function tests after initial recording at baseline. Values of recorded FVC, FEV_1 and FEV_1/FVC% were collected from the digitized software processed autogenerated computer monitor and recorded in data sheet. Data were expressed as mean SE of the percentage of predicted value. The measured value of each spirometric parameter expressed as percentage of predicted value was used in analysis. Data were checked for validity and normal distribution was checked by Shapiro - wilk test. For statistical analysis, One way ANOVA, Independent sample 't' test and paired sample t test were applied by using SPSS. In the interpretation of results, p value < 0.05 was accepted as level of significance.

Results

Socio-demographic data and baseline spirometric measures of 30 control and 60 MDD patients were obtained. Data were found normally distributed.

Table I: Demographic characteristics of subjects all groups (n=90)

Parameters	Group A (n=30)	Group B1 (n=30)	Group B2 (n=30)
Age (years)	34.40±1.72	34.13±1.49	34±40
BMI ($kg/m^{2)}$	27.03±0.64	27.51±0.56	26.66±0.55
SBP (mm of Hg)	121±1.79	120±1.86	120±1.87
DBP (mm of Hg)	80.83±1.66	79.00±1.73	79.33±1.63

Data are given as mean ±SE. statistical analysis was done by ANOVA with post hoc BMI=Body mass index. SBP= Systolic blood pressure, DBP = Diastolic blood pressure. Group A= Healthy control, Group B1 = MDD patients designated for medication only at baseline, Group B2 = MDD patients designated for SBE at baseline.

Mean ± SE Age, BMI, SBP & DBP of all subjects in healthy control and all newly diagnosed drug naive MDD patients were similar and there were no significant differences among these groups (p>0.05). So, all these confounding variables are matched for both patients and control.

In this study, the mean ± SE of percentage of predicted values of FVC, FEV_1 and FEV_1/FVC% were found significantly lower (p< 0.001, p<0.01) in both groups of newly diagnosed MDD patients than those of control at baseline. (table II)

Table II: Predicted values of FVC, FEV_1, FEV_1/FVC % in different groups at baseline. (n=90)

Parameters	Group A (n=30)	Group B1 (n=30)	Group B2 (n=30)
FVC	89.13±1.32	70.36±2.14***	67.86±1.99***
FEV_1	85.83±2.24	52.73±3.55***	52.26±3.88***
FVC/FEV_1%	95.40±2.57	74.56±4.78***	78.53±4.93**

Data are given as mean ±SE. For statistical analysis ANOVA and post hoc analysis was done. FVC= Forced vital capacity, FEV_1= Forced expiratory volume in first second. Group A= control, Group B1 = newly diagnosed MDD patients before medication only at baseline, Group B2 = newly diagnosed MDD patients before intervention with SBE and medication at baseline. ***p<0.001,**p<0.01(B1vs A & B2 vs A)

But there were no significant differences in these parameters between the two groups of newly diagnosed MDD patients before intervention (B1vs B2). Therefor both the patient groups at baseline have similar lung function but it was reduced compare to healthy subjects.

Furthermore, FVC, FEV_1 and FEV_1/FVC% significantly (p<0.001) increased in $B2_b$ compared to $B2_a$ but these parameters were not significantly different in $B1_b$ compared to $B1_a$. Moreover, the values of these parameters were found significantly (p<0.001; p<0.01; p<0.05) higher in $B2_b$ compared to $B1_b$ (table III). These indicate lung function improved in patients after 3 months of performing SBE along with medication but lung function was almost similar in patients under anti depressive medication only. Even after 3 months of follow up the lung function was found better in patients with SBE compared to patients without SBE.

Table III: Pre and post intervention (percentage of predicted) values of FVC, FEV_1, FVC/ FEV_1% in different groups. (n=90)

Parameters	GroupB1$_a$ (n=30)	Group B1$_b$ (n=30)	GroupB2$_a$ (n=30)	Group B2$_b$ (n=30)
FVC	70.4±2.1	70.3±2.1	67.9±2.0	78.6±1.9$^{***\#\#}$
FEV_1	52.7±3.6	59.7±2.8	52.3±3.9	74.0±2.3$^{***\#\#\#}$
FVC/FEV_1%	74.6±4.8	87.8±3.6	78.5±4.9	96.9±2.3$^{***\#}$

Data are given as mean ±SE. For statistical analysis, paired t and unpaired t test was done. FVC= Forced vital capacity, FEV_1= Forced expiratory volume in first second, Group B1a = MDD patients with only medication at baseline, B1b = MDD patients after 3 months of medication only. Group B2a = MDD patients with SBE at baseline. Group B2b = MDD patients after 3 months of intervention with SBE & medication. ***p<0.001($B2_b$ vs $B2_a$); ### p<0.001, ##p<0.01, #p<0.05($B2_b$ vs $B1_b$)

Discussion

This study investigated the effect of intervention with slow breathing exercise on some spirometry measures of lung function in female MDD patients. Results of this study showed FVC, FEV_1 and FVC/FEV_1 were significantly reduced in newly diagnosed MDD patients compared to healthy control. These results agree to other researchers.[4-5] Islam and coworkers found lower value of FVC and FEV_1 but higher FVC/FEV_1 in MDD patients than healthy control and patients with minor depressive illness.[4] Though Calikoglu and his colleagues did not find significant difference in lung function parameters but found dyspnea was higher in MDD patients.[16] The result of this study suggest depressed lung function in untreated MDD patients.

In this study, lack of significant change in FVC FEV_1 and FVC/FEV_1 in MDD patients after 3months of treatment with anti-depressive drugs only suggests that anti-depressive drug have no apparent effect of on lung function.

Again, values of FVC, FEV_1 and FVC/FEV_1 significantly increased in MDD patients after performing 3 months of SBE which agree to other investigators but they observed this effect in healthy volunteers with different duration of slow breathing exercise.[7,10,13,16-20] But one study on bronchial asthma patient found no significant change in FEV_1 after seven days of yoga training.[21]

The apparent effect of depression causing poor lung function in MDD patients may be explained by the reduced psychomotor activity along with poor respiratory muscle strength in depressive illness.[22]

It is noteworthy that overall lung function was significantly improved in MDD patients after 3 months of slow breathing exercise (Anuloma Viloma), whereas no significant improvement of lung function was noted in MDD who continued with only anti-depressive medication. Moreover, the further decreased values of spirometry parameters in these patients is suggestive of further deterioration of lung function in these patients after 3 months and also anti-depressive medication apparently had no beneficial effect on lung function though it can improve some symptoms of depressive illness.

Slow breathing exercise is a type of yogic breathing exercise (pranayam) which is a well studied breathing technique used to improve lung function in healthy subjects and also have shown a promise for such improvement in lung function in some pulmonary diseases.[9,19,23-24]

The benefit of SBE for improvement of lung function in MDD is evident from the outcome of this study which support Dojid and Surdi who also viewed that it can be advocated for increasing respiratory efficiency of healthy as well as an alternative therapy or as an adjunct to conventional therapy of various diseases affecting lung function.[23]

The improvement of respiratory efficiency by SBE may be attributed to its deep inhalation and prolonged expiration causing efficient use of diaphragm and abdominal muscle and intercostals muscles which ultimately improves the strength of these respiratory muscles. In addition, the stress on more prolonged expiration, deep inspiration trains the respiratory apparatus for more efficient and complete emptying and filling of airways.[10,23] The poor strength for lung ventilating performance due to poor muscular strength due to depression was thus overcome by the increased strength of respiratory muscle achieved by SBE.

Conclusion

Based on the results of this study, it may be concluded that regular performance of slow breathing exercise may improve poor lung function in MDD patients. whereas anti depressive drug may not have any effect on lung function in major depressive disorder.

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