

## ORIGINAL ARTICLE

# Blowing Balloons, A Novel Way for Reducing Stress and Improving Pulmonary Function Tests

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## ABSTRACT

**Objective:** To determine the effect of blowing balloons on pulmonary function tests and perceived level of stress in medical students.

**Study Design:** Pretest-posttest quasi-experimental study.

**Place and Duration of Study:** This study was conducted at Department of Physiology, Islamic International Medical College from 1<sup>st</sup> April 2016 to 31<sup>st</sup> May 2016.

**Materials and Methods:** Sixty students of Islamic International Medical College participated in the study after fulfilling the DASS (Depression Anxiety Stress Scale) Questionnaire Performa. Pulmonary function tests of the participants were measured according to the standard guidelines published by American Thoracic Society. This was recorded by using Power lab and the data was then analyzed by using software, Lab chart 8 pro. The participants were then subjected to a supervised blowing balloon exercise using commercially available balloons. After completion of exercise, pulmonary function tests of the participants and the DASS Questionnaire was filled again by the participants.

**Results:** After blowing balloon exercise DASS Score of the participants was reduced from  $21.87 \pm 2.01$  to  $13.41 \pm 4.29$  ( $p < 0.001$ ). Tidal volume was increased from  $517.72 \pm 48.57$  ml to  $638.65 \pm 86.02$  ml ( $p < 0.001$ ), Vital capacity was increased from  $3.51 \pm 0.56$  L to  $4.83 \pm 0.77$  L ( $p < 0.001$ ) and the ratio of Forced Expiratory Volume in one second to the Forced vital capacity was improved from  $89.36 \pm 4.54$  % to  $92.66 \pm 4.27$  % ( $p < 0.001$ ) after blowing balloon exercise.

**Conclusion:** Blowing balloon exercise is an effective way of improving pulmonary function tests and alleviating stress levels in medical students.

**Key Words:** *Depression Anxiety Stress Scale, Lab Chart, Pulmonary Function Tests, Stress.*

## Introduction

Stress is defined as the inability of an individual to respond sufficiently towards a physical, emotional or mental demand. It affects Psychological wellbeing of students, which is an area of increasing concern worldwide.<sup>1,2</sup> Medical students are more prone to experience level of depression, anxiety and stress. Studies have shown that low level of stress was

present in 7.5%, moderate level of stress was present in 71.67%, and high level of stress was present in 20.83% of the medical students.<sup>3,4</sup> Perceived level of stress in an individual can be measured by using validated and reliable DASS (Depression Anxiety Stress Scale) questionnaire. On the basis of the score an individual can be labeled as stress free or suffering from mild, moderate, severe or extreme severe stress.<sup>5</sup>

Pressure of Academic workload, competitive environment, financial pressure, inadequate relationship with peers and teachers, physical illness, worries about future, poor food quality, overcrowding of students in hostel rooms, minimal opportunities for the students to relax are among the major stressors faced by the medical students.<sup>6-8</sup> Inability of the medical students to cope with these stressors leads to poor scholastic performance, interpersonal relationship difficulties, reduction in attention, concentration and decision making skills. It causes dropout from medical course and even

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development of suicidal behavior in these medical students.<sup>9</sup>

Students employ many techniques to cope with stress, for example discussion with seniors, use of internet chat and cell phone texting<sup>5</sup>, attending meditation, hypnosis, group discussions, counseling sessions<sup>10</sup>, cycling, jogging and yoga.<sup>11,12</sup>

The main goal of breathing exercise is to improve pulmonary function tests (PFTs) which provides measurable feedback about the function of the lungs by assessing flow rates, lung volumes, and capacities.<sup>13,14</sup> The practice of breathing exercises can decrease stress and strain through the reduction in sympathetic activity and enhancement of parasympathetic activity. Pattern of discharge via vagal neurons is influenced by the respiratory rhythm of the body. Vagal neurons receive powerful excitatory input from pulmonary stretch receptors as a consequence vagal nerve activity i.e. parasympathetic activity is increased.<sup>14</sup> Breathing exercises include various forms of yoga exercise, slow lip pursuing exercise, blowing balloon exercise etc.<sup>15</sup>

Blowing balloon exercise has been documented in improving pulmonary function tests of smokers, for treating obstructive sleep apnea syndrome, in rehabilitation of stroke patients and in oral gymnastics.<sup>16,17</sup> The blowing balloon exercise strengthen the respiratory muscles and results in the increase of Tidal Volume (TV), Vital Capacity (VC), Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1) and Forced Expiratory Volume in one second to the ratio of Forced Vital Capacity (FEV1/FVC).<sup>18</sup>

To combat stress encountered in a medical school environment, students are advised to get themselves involved in stress reducing activities like counseling sessions, physical exercises including gym, running, swimming, yoga etc.<sup>10,11</sup> However, all these activities are time consuming, a major barrier for medical students to practice them regularly.

In order to enhance students' performance and academic achievement in inherently stress full medical college environment, provision of cost effective, less time consuming fun activities for coping stress is the need of hour. The role of blowing balloons in reducing stress has not been studied yet. The objective of the current study was to assess the

effectiveness of blowing balloon therapy in relieving the perceived level of stress in medical students.

## Materials and Methods

This pretest-posttest quasi-experimental study was conducted at Department of Physiology, Islamic International Medical College from 1<sup>st</sup> April 2016 to 31<sup>st</sup> May 2016.

A total of sixty participants were selected by simple random sampling through balloting method with an equal contribution from both genders. The study was conducted after getting approval from institutional ethical review committee. Initially DASS Questionnaire was distributed and filled by 200 students of 1<sup>st</sup> and 2<sup>nd</sup> year MBBS after written informed consent. Healthy subjects having age between 18-25 years, who scored 19 – 25 on DASS Performa (having moderate level of stress) were labelled as eligible. Subjects who were smokers, having oral lesions, using bronchodilator medicines or practicing any form of breathing exercise were not included.

Study participants were asked to reach physiology department between 8.00 - 9.00 am. They were made to relax for five minutes and then height, weight and blood pressure of the participants were recorded.

Pulmonary function tests comprising on tidal volume, vital capacity, forced vital capacity, forced expiratory volume in one second and the ratio of forced expiratory volume in one second to the forced vital capacity of the participants were measured by performing Spirometry by using Power lab 4/25T. Pulmonary function tests of the participants were measured according to the standard guidelines published by American Thoracic Society and European Respiratory Society.<sup>19</sup> Recorded data in the Power lab was analyzed by using Lab chart 8 pro software.

The study participants were subjected to a supervised blowing balloon exercise for a period of three days a week for six consecutive weeks using commercially available balloon.<sup>15</sup> During blowing balloon exercise participants were asked to obtain an upright position, breathe in maximum, maintain their state for one second then breathe out in balloon mouth. Then participants were requested to close the balloon mouth with their fingers. Participants were then again asked to breathe in

maximum, maintain their state for one second and breathe out in balloon. This completed their one mini set. They were asked to perform three mini sets in order to complete one set. A total of three sets were performed by them in a day.

To prevent fatigue participants were provided with a 2-3 minute break between consecutive sets. Subjects were advised to stop exercise whenever they felt dizzy. To prevent valsalva subjects were advised to not hold their breath for more than five seconds after they breathed out. After completion of blowing balloon exercise, pulmonary function tests of the participants were again measured by performing Spirometry through powerlab. Study participants were again provided with the DASS Questionnaire Performa and were requested to fill it. The parametric data was analyzed in term of Mean  $\pm$  Standard deviation by using statistical software SPSS version 21. Difference in the DASS score and Pulmonary Function Test of the study participants before and after the blowing balloon exercise was determined by using Parametric Paired t test. p value of <0.05 was considered as statistically significant.

**Results**

Our study included sixty participants, all of the participants completed all the sessions of blowing balloon exercise and there was no drop out. Difference in the DASS score and pulmonary function test indices before and after performing blowing balloon exercise were compared.

The mean age of the participants was 20.5  $\pm$  1.2 years. Descriptive statistics of the study participants are given in table I.

Table II shows the pulmonary function test indices.

**Table I: Descriptive Statistics of Study Participants (N= 60)**

Characteristics	Participants N = 60 Mean $\pm$ S.D
Age ( years)	20.50 $\pm$ 1.24
Height (cm)	167.98 $\pm$ 9.29
Weight (Kg)	61.31 $\pm$ 11.94
BMI ( Kg/m <sup>2</sup> )	21.67 $\pm$ 3.70
Systolic Blood Pressure (mmHg)	118.17 $\pm$ 4.69
Diastolic Blood Pressure (mmHg)	77.83 $\pm$ 6.13

All the indices of pulmonary function test i.e. tidal volume TV, VC, FVC, FEV1 and FEV1/FVC were significantly improved after performing blowing balloons exercise.

Table III shows the DASS Score of study participants. The mean DASS Score of the participants was 21.87  $\pm$  2.01 before the commencement of blowing balloon exercise. This score was significantly decreased to the value of 13.41  $\pm$  4.29 after performing six weeks blowing balloon exercise.

**Table II: Comparison of Pulmonary Function Tests before and after Blowing Balloon Exercise**

Pulmonary Function Test Parameter	Values before Blowing Balloons Exercise Mean $\pm$ S.D N = 60	Values After Blowing Balloons Exercise Mean $\pm$ S.D N = 60	p value
Tidal volume ( milliliters )	517.72 $\pm$ 48.57	638.65 $\pm$ 86.02	.000*
Vital capacity (liters)	3.51 $\pm$ 0.56	4.83 $\pm$ 0.77	.000*
Forced Vital Capacity (liters)	3.09 $\pm$ 0.57	4.45 $\pm$ 0.78	.000*
Forced Expiratory Volume in one second (liters)	2.76 $\pm$ 0.54	4.13 $\pm$ 0.77	.000*
Forced Expiratory Volume in one second / Forced Vital Capacity ( percentage)	89.36 $\pm$ 4.54	92.66 $\pm$ 4.27	.000*

\*p value < 0.05 is significant

**Table III: Comparison of Participant's Dass Score before and after Blowing Balloon Exercise**

Measuring variable	Participants before Blowing Balloons Exercise Mean $\pm$ S.D	Participants after Blowing Balloons Exercise Mean $\pm$ S.D	p value
DASS Score	21.87 $\pm$ 2.01	13.41 $\pm$ 4.29	.000*

\*p value < 0.05 is significant

**Discussion**

Medical colleges are notoriously famous for being stressful and this stress often exerts negative effect on the physical, psychological and academic

wellbeing of the students. The current study was conducted with an aim to find an effective way to alleviate stress among the students of medical college.

The current study shows that blowing balloons for six weeks resulted in significant improvement in TV, VC, FVC, FEV1 and FEV1/FVC indices of pulmonary function tests. Moreover blowing balloons significantly reduced the perceived stress score of medical students.

Findings of the present study are in accordance with the study conducted by Antte Kjellgren et al which showed that practice of yogic breathing exercise for 3 hours/day for 6 days/week for seven weeks resulted in reduction of depression, anxiety and stress levels in students. The compliance rate of yogic exercise was 94.17%.<sup>20</sup> However, the participants of the present study used blowing balloons exercise as a stress coping strategy and performed exercise for ten minutes in a day for 3 days/week for six consecutive weeks and the compliance rate was 100%.

Results of our study also support the findings of study conducted by Shapiro et al which reported that use of yoga, meditation and group discussion as stress coping strategy for 2.5hours/week for seven weeks resulted in significant reduction in stress levels of students. The compliance rate of the study participants were 93.5%.<sup>11</sup> In present study we used blowing balloon exercise as a stress coping strategy instead of yoga, meditation and group discussion. The compliance rate of our participants was 100%. Moreover our participants performed exercise for just ten minutes in a day for 3 days/week for six consecutive weeks instead of long sessions done by the participants of Shapiro, et al.

During blowing balloons in order to keep balloon inflating, the resistance of inflated balloon rubber is overcome by forceful expiration this results in the active contraction of Rectus abdominus, Transversus abdominus and intercostal muscles. Expiratory muscles get trained through this exercise.

Kim, J et al conducted a study on young adult smokers which concluded that blowing balloon exercise resulted in a significant improvement in several parameters of pulmonary function tests (VC, FVC, FEV1, FEV1/FVC).<sup>15</sup> Our study also concluded that blowing balloon exercise resulted in a significant improvement in pulmonary function tests including

tidal volume. However, in the study by Kim, J et al, tidal volume was not measured. Results of this study is also in accordance with a study conducted by Jun, H et al, which showed that blowing balloon exercise for four weeks by elderly smokers resulted in an increase in VC, FVC, FEV1, FEV1/FVC, PEF.<sup>21</sup> In comparison with these studies this study was conducted on stressed otherwise healthy nonsmoker medical students.

V Blessy et al conducted a research on healthy subjects and performed Bhastrika pranayama exercise for five times a day for three months. In this exercise participants took slow and deep inhalation followed by forceful exhalation from the nose, resulted in improvement in TV, FVC, FEV1/FVC of study participants ( $p < 0.02$ ).<sup>22</sup> Pulmonary function indices (TV, VC, FVC, FEV1, FEV1/FVC) of the participants of this study also showed significant improvement ( $p < 0.000$ ). However, the current study participants performed blowing balloon exercise in which exhalation was done against a resistance which could be the possible reason for the marked improvement of pulmonary function tests as compared to the improvement in pulmonary function tests due to Bhastrika pranayama exercise used by V Blessy et al in which simple forceful exhalation was done.

A study conducted by Mauch AD on young healthy adults showed that practicing of Iyengar yoga for two weeks lead to an increase in TV, FVC FEV1/FVC of participants ( $p < 0.01$ ). Participants were asked to take deep breath and then they were instructed to hold breath for few seconds in triangular standing posture.<sup>23</sup> Our blowing balloon exercise also resulted in the significant improvement in pulmonary function test of the participants however our exercise can be performed at without any posture restriction.

In spite of the fact that the study was conducted under the available resources and facilities the exercise period could have been extended from 6 weeks up to 6 months. In future effect of blowing balloon exercise can be compared with other stress coping strategies like yoga, cycling or treadmill exercise etc.

### Conclusion

Our study concluded that blowing balloons exercise improves pulmonary function tests and reduces the

level of stress in medical students. It is a cost effective and less time consuming method which can be used by the students as a stress coping strategy.

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