Recent Research in Science and Technology 2010, 2(11): 11-16
ISSN: 2076-5061
www.recent-science.com

MEDICAL SCIENCES

EFFECT OF MEDITATION TRAINING ON PULMONARY FUNCTION TESTS

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Abstract

Meditation is a wakeful hypometabolic state associated with greater alertness and causes significant reduction in heart rate, respiratory rate, oxygen consumption, anxiety and plasma cortisol[1]. Regular practice of meditation is highly beneficial and effective in reduction of stress. Meditation involves breathing technique which helps to improve breathing pattern and can be a boon to minimize respiratory disorders. Deep breathing is one of the simplest ways that one can learn to relax. Most of the studies on effect of meditation have been coupled invariably with practice of set of asanas and kriyas. This study differs from others as we have tried to find effects of meditation alone in Sukhasana posture only, on parameters related to respiratory functions in healthy young medical students. Resting respiratory rate, Tidal Volume, Minute Volume, Vital Capacity, FEV1, FEV% and MVV were recorded before meditation training and practice and after a period of meditation training and practice and the results were compared. The decrease in respiratory rate after meditation practice was statistically significant ($p<0.001$). After twelve weeks of meditation practice there was a statistically significant increase in the Tidal Volume ($p<0.01$). After twelve weeks of meditation practice there was statistically significant reduction in the Minute Volume ($p<0.02$). After twelve weeks of meditation practice there was no statistically significant change in the Vital Capacity, FEV1, FEV1/VC, FVC, FEV1/FVC, ERV, IRV, IC, MMEF, PEF, MEF, and MVV. Twelve weeks of meditation practice alone, without incorporating asanas caused significant reduction in some of the respiratory parameters. Regular practice of meditation is highly beneficial in reduction of stress and to keep good general and respiratory health.

Keywords: Meditation, Stress, PFT, Breathing, Sukhasana

Introduction

Everyone experiences stress because of our modern life style which is highly competitive, challenging and with full of tensions. Stress is a non-specific response of the body caused by various stressors. Various studies conducted worldwide indicate 75% of general population experiences stress and workplace stress reported to be 32% which is more common in executives especially in women[2]. Nowadays even younger age group belonging to professional courses encounter high degree of stress because of competitive curriculum and intense academic competitions more so during challenging situation like examinations[3].

Deep breathing is one of the simplest ways we can relax. As we slow down our breathing while focusing on our abdomen (lower belly), we produce dramatic positive physiological and psychological effects. Stress, anxiety, worry have altered our breathing patterns. Instead of breathing in a manner that increases the oxygen to every cell in our body and naturally relaxes us, we have learned to take short, shallow upper chest breaths, hold our breath or take short panting breaths. All of these learned breathing techniques are harmful to our health and create additional stress. Even if we are not stressed or anxious these kinds of learned breathing patterns will, without conscious thought or choice automatically produce and reinforce stress. These breathing pattern and associated stress, then become habitual. When we take short, shallow breaths the oxygen level of blood drops and carbon di oxide level increases. To discharge the carbon di oxide, our body senses a need to breathe harder producing added tension on our breathing mechanism. As the diaphragm tenses our abdominal and intercostal muscle contract and we lose the ability to inhale deeply and naturally; at the very moment that we require it the most. Abdominal or deep breathing relaxes tight muscles and opens up blood vessels causing our heart to pump more efficiently. It also helps us to think more clearly thus allowing us to stay calmer in stressful situations. Deep breathing encourages an adequate amount of oxygen to every cell in the body, thus producing many wide spread positive effects.

Now a days stress reduction programmes are becoming essential. The benefits of such programme have convinced even big corporations including NASA. Stress is a hypermetabolic physiological state associated with increased heart rate, blood pressure, respiratory rate, oxygen consumption and blood flow[4]. Meditation which is a wakeful hypometabolic state

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Editor: Dr. Krishna Mohan Surapaneni

associated with greater alertness and causes significant reduction in heart rate, respiratory rate, oxygen consumption, anxiety and plasma cortisol[1]. Meditation by relaxation response helps to counteract the biochemical changes that cause stress. Meditation modulates stress responses and modifies once attitude towards stress. Meditation is the best effortless relaxation technique which is easy to learn and practice in daily life. Regular practice of meditation is highly beneficial and effective in reduction of stress[5].

Most of the studies on effect of meditation have been coupled invariably with practice of set of asanas. Aged and especially physically weak people may not be able to perform these asanas. There is paucity of studies of effects of meditation alone without incorporating asanas & kriyas. Even some people have difficulty in meditating by adopting Padmasana, but Sukhasana can be easily adopted by any person. Hence this study was undertaken to find out the effect of meditation in Sukhasana posture only, on some parameters related to respiration in healthy young medical students. Though practice of various asanas was not included in this study, only Sukhasana which is the posture required for performing meditation was included. Meditation along with OM chanting was taught and practiced.

Aims and Objectives

The study was undertaken to observe the effect of meditation in Sukhasana posture on parameters related to respiration in young healthy medical students.

The following parameters were studied.

Resting Respiratory rate.

Tidal Volume.

Minute Volume.

Vital Capacity, FEV1, FEV1/VC, FVC, FEV1/FVC, ERV, IRV, IC, MMEF, PEF, MEF, and MVV.

Objectives were to record the above parameters before meditation training and practice in meditation group and after a period of meditation training and practice for 12 weeks in same meditation group and compare the two.

Materials

This study was conducted in the Department of Physiology, KIMS Hubli. After calculation of sample size, twenty five students who came voluntarily to participate in the study were included. This group was called Meditation group denoted by 'M'. This group underwent meditation training for one week followed by meditation practice for 12 weeks.

A detailed physical and clinical examination of each participant was carried out and no abnormality was found. All subjects were right handed, non smokers, non alcoholics and took no drug. They had almost similar dietary intake, activity and life style. They also agreed not to change their lifestyle, diet and activity during the study period. These subjects never underwent meditation training, relaxation exercises and sports related training, in the past and also during the study period. All subjects had normal vision and hearing and were found to be sound physically, mentally, emotionally and psychologically.

Method

The following parameters recorded in two phases. First or initial reading was taken well before the participants of meditation group joined meditation course, henceforth denoted by 'M-1' indicating premeditation readings. Final readings were recorded after the participants of meditation group completed the meditation training and practice, henceforth denoted by 'M-2', measurements stand for post meditation readings. Respiratory Rate, Tidal Volume, Minute Volume, Vital Capacity, FEV1, FEV1/VC, FVC, FEV1/FVC, ERV, IRV, IC, MMEF, PEF, MEF, and MVV were recorded by using electronic spirometer called Spirolyser model 2spl-100 manufactured by F I M company.

MEDITATION COURSE: The Meditation course was conducted for 13 weeks. Meditation training was conducted for one week by a qualified Yoga trainer. This was followed by meditation practice under supervision for 12 weeks. The students were asked to adopt Sukhasana posture and chant OM for a period of 30 minutes in two spells of 15 minutes each with a rest period of 5 minutes in between during which they were asked to relax.

Results

All the above parameters were recorded in two phases. First reading was taken well before the participants of meditation group joined the meditation course. Henceforth denoted by 'M-1' indicating premeditation readings. Final readings were recorded after the participants of meditation group completed the meditation training and practice. Henceforth denoted by 'M-2', measurements stand for post meditation readings. Statistical analysis of data was done by using paired t-tests and values of t and p were calculated. Value of 0.05 or less was taken as statistically significant.

RESTING RESPIRATORY RATE : Initial values of Resting Respiratory Rate (breaths/minute) in the premeditation group (M-1) was 19.24 ± 0.971.

The Resting Respiratory Rate in postmeditation group (M-2), that is at the end of 12 weeks of meditation practice was 9.68 ± 0.736. The decrease in respiratory rate after meditation practice was statistically significant ($p<0.001$) [Table–1 and Graph-1].

TIDAL VOLUME : Initial values of Tidal Volume (Liters/breath) in the premeditation group (M-1) was 0.464 ± 0.039.

The Tidal Volume (Liters/breath) in postmeditation group (M-2), that is at the end of 12 weeks of meditation practice was 0.650 ± 0.055. The increase in Tidal Volume after meditation practice was statistically significant ($p<0.01$) [Table–1 and Graph-2].

MINUTE VOLUME : Initial values of Minute Volume (Liters/minute) in the premeditation group (M-1) was 8.953 ± 1.003.

The Minute Volume (Liters/minute) in postmeditation group (M-2), that is at the end of 12 weeks of meditation practice was 5.849 ± 0.563. The decrease in Minute Volume after meditation practice was statistically significant ($p<0.02$) [Table–1 and Graph-3].

VITAL CAPACITY : Initial values of Vital capacity (Liters) in the premeditation group (M-1) was 3.48 ± 0.105.

The Vital capacity (Liters) in postmeditation group (M-2), that is at the end of 12 weeks of meditation practice was 3.69 ± 0.124. After twelve weeks of meditation practice there was no statistically significant change in the Vital Capacity [Table–1 and Graph-4].

FEV1 : Initial values of FEV1 (Liters) in the premeditation group (M-1) was 2.948 ± 0.116.

The FEV1 in postmeditation group (M-2), that is at the end of 12 weeks of meditation practice was 2.955 ± 0.082. After twelve weeks of meditation practice there was no statistically significant change in the FEV1 [Table–1 and Graph-6].

FEV1/VC : Initial values of FEV1/VC in the premeditation group (M-1) was 0.84 ± 0.025.

The FEV1/VC in postmeditation group (M-2), that is at the end of 12 weeks of meditation practice was 0.8008 ± 0.0203. After twelve weeks of meditation practice there was no statistically significant change in the FEV1/VC [Table–1 and Graph-7].

FVC : Initial values of FVC in the premeditation group (M-1) was 3.29 ± 0.100.

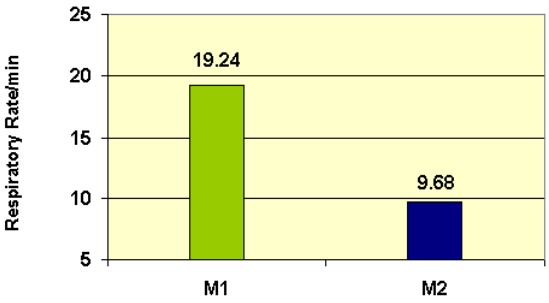
The FVC in postmeditation group (M-2), that is at the end of 12 weeks of meditation practice was 3.303 ± 0.092. After twelve weeks of meditation practice there was no statistically significant change in the FVC [Table–1 and Graph-5].

FEV1/FVC : Initial values of FEV1/FVC in the premeditation group (M-1) was 0.887 ± 0.026.

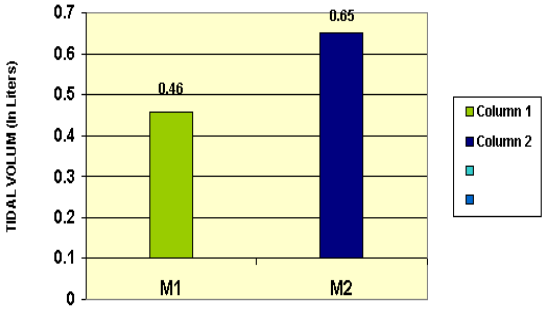
The FEV1/FVC in postmeditation group (M-2), that is at the end of 12 weeks of meditation practice was 0.892 ± 0.012. After twelve weeks of meditation practice there was no statistically significant change in the FEV1/FVC [Table–1 and Graph-7].

OTHER RESPIRATORY PARAMETERS: ERV, IRV, IC, MMEF, PEF, MEF, and MVV were also recorded and analysed statistically, but none of values showed statistically significant difference.

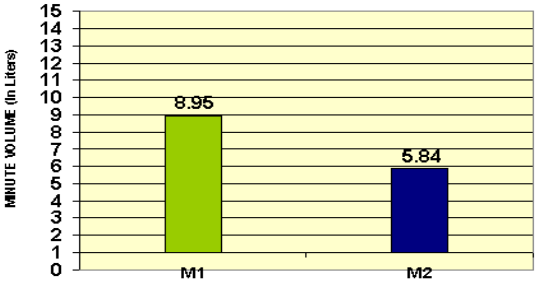
Graph -1: Resting respiratory rate (Mean ± SEM)



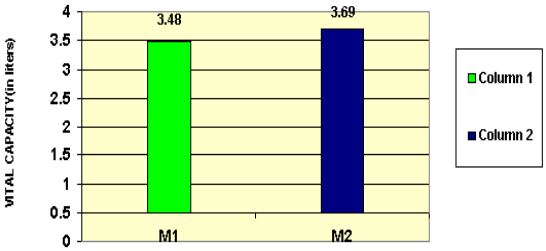
Graph -2: Tidal volume (TV) (Mean ± SEM)



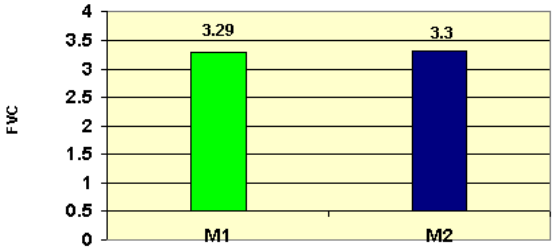
Graph -3: Minute ventilation (Mean ± SEM)



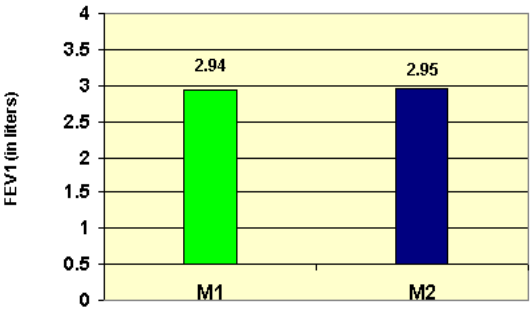
Graph -4: Vital capacity



Graph -5: FVC



Graph -6: FEV1



Graph -7: FEV1/VC & FEV1/FVC

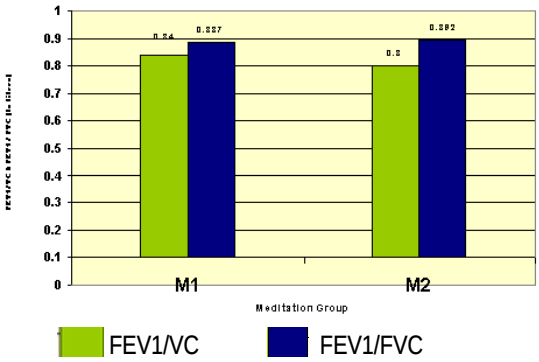


Table-1: Resting Respiratory Rate, Tidal Volume, Minute Volume, VC, FEV1, FEV1/VC, FVC and FEV1/FVC during Premeditation and Postmeditation period

Parameters	M-1	M-2	Significance level
Resting Respiratory Rate (breaths/minute)	19.24 ± 0.971	9.68 ± 0.736	*P<0.001
Tidal Volume (liters/breath)	0.464 ± 0.039	0.650 ± 0.055	*p<0.01
Minute Volume (Liters/minute)	8.953 ± 1.003	5.849 ± 0.563	* p<0.02
Vital Capacity (Liters)	3.48 ± 0.105	3.69 ± 0.124	NS
FEV1 (Liters)	2.948 ± 0.116	2.955 ± 0.082	NS
FEV1/VC	0.84 ± 0.025	0.8008 ± 0.0203	NS
FVC	3.29 ± 0.100	3.303 ± 0.092	NS
FEV1/FVC	0.887 ± 0.026	0.892 ± 0.012	NS

* Indicates Statistically Significant NS Indicates NOT Statistically Significant

Discussion

Majority of scientific studies shows meditation to be a wakeful state accompanied by decreased metabolism. The generalized decrease in metabolism manifests with decreased respiratory rate.

The decrease in respiratory rate in meditation group after meditation practice was statistically significant (P< 0.001). Corey, Paul[6] found increased airway conductance and increased ease of breathing during and after meditation practice. Wallace RK[7] reports significant decrease in respiratory rate with a mean decrease of 3 breaths/min during meditation and in one subject respiratory rate decreased from 12/min to 4/min. John T Farrow[8] in his study reported statistically significant reduction in respiratory rate, wherein he observed 60% reduction in respiratory rate. During meditation practice respiratory rate decreases due to natural reduction in metabolic activity at cellular level and not from a forced reduction of breathing. The reduction in respiratory rate was due to decreased metabolic rate.

Our results show statistically significant (p<0.01) increase in Tidal Volume after twelve weeks of meditation practice. Studies shows that Meditative practices are associated with slow and deep type of breathing. Hence respiratory rate decreases but there is an increase in Tidal Volume. The breathing pattern observed by spirometry also supports this observation. Wolkowe. N, et al[9] reported decrease in the Minute Ventilation, Tidal Volume and changes in breathing

pattern during meditation. But Dhanaraj VH and Singh, M[10] found decreased Tidal Volume during practice of meditation.

The decrease in Minute Volume after meditation practice was statistically significant ($p<0.02$) which may be due to hypometabolic state induced by meditation.. This was due to decrease in Respiratory Rate and an increase in Tidal Volume. John T Farrow[8] in his extensive study reported statistically significant reduction in respiratory rate, minute ventilation during and after meditation. He found 35% reduction in minute ventilation. Wallace RK[11], reported decrease in minute ventilation is associated with meditative practices.

VC, FEV1, FEV1/VC,FVC, FEV1/FVC, ERV, IRV, IC, MMEF, PEF, MEF, and MVV were also recorded and analyzed statistically, but none of these values showed statistically significant difference.

A three months study of managers and employees who regularly practiced meditation in a fortune 100 manufacturing company showed, meditation practitioner displayed more relaxed physiological functioning, greater reduction in anxiety and reduced tension during jobs. This is due to reduction in limbic arousal. Limbic system contains hypothalamus which controls autonomic nervous system which is responsible for reduction of stress.

Summary and Conclusion

After 12 weeks of meditation practice there was significant reduction in Respiratory Rate, Minute ventilation and increase in Tidal Volume. Stress is a hypermetabolic physiological state associated with increased heart rate, blood pressure, respiratory rate, oxygen consumption and blood flow. Meditation which is a wakeful hypometabolic state associated with greater alertness and causes significant reduction in Respiratory Rate, Minute Ventilation. Most of our observations are attributable either entirely or largely to induction of a hypometabolic state / relaxation response by meditation. Most of the studies on effect of meditation have been coupled invariably with practice of a set of asanas and kriyas. Old and physically weak people may not be able to perform these asanas. There is paucity of study of effects of meditation alone. Hence this study was undertaken to find out effect of meditation in only sukhasana posture, on some respiratory parameters in healthy young medical students. Some Pulmonary Functions like VC, FEV1, FEV1/VC,FVC, FEV1/FVC, ERV, IRV, IC, MMEF, PEF, MEF, and MVV were also recorded and analyzed statistically, but none of these values showed statistically significant difference. This may be due to, our study subjects were young healthy subjects, having normal respiratory functions and without any respiratory disorders.

Though Practice of various asanas were not included, only sukhasana which is the posture required for performing meditation was included, OM meditation along with OM chanting was taught and practiced. Hence only meditation without asanas and kriyas is also effective on respiratory health. This can be a boon to the patients with respiratory disorders, who have already crossed middle age and may not be able to carry out various asanas. Meditation brings better harmony between mind and body, which is essential to face stressful situations. Meditation modulates stress response and modifies one's attitude towards stress. Regular practice of meditation is highly beneficial in reduction of stress and to keep good health. Formal meditation refers to the practice of meditation at specific place and posture, as practiced in yoga centers. Informal meditation, however requires no specifications, but can be practiced at any time and place. The primary goal of meditation is not just simply to be able to make a meditative effort during formal sittings, but to maintain and generalize conscious attention to all aspects of our physical body in general there by eliminating mental tension.

Ultimately the greatest achievement in human life is the simultaneous refinement of mind and body. Cultivation of the mind leads to cultivation of the body, leading to further cultivation of the mind and so on, eventually attaining an exquisite level of cooperation and coordination between two.

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