



## EFFECT OF TRANSCENDENTAL MEDITATION ON RESPIRATORY RATE AND BREATH HOLDING TIME

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**Abstract-** Effects of six weeks training followed by six weeks practicing session of TM was studied on respiratory rate and breathe holding time in 37 male and 38 female volunteers. There was significant decrease in respiratory rate and significant increase in breathe holding time in both males and females after TM session. It is therefore concluded that regular practice of TM would increase respiratory efficiency and would be useful in preventing and treating psychosomatic and other respiratory diseases.

**Key Words-** Transcendental Meditation, Breath Holding Time, Respiratory Rate

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### Introduction

Autonomic nervous system links brain and body [1] Several workers have studied the effects of yogic practices on autonomic nervous system [2, 3, 4, 5] It is quite likely that through this system such yogic practices improve the efficiency of respiratory system. Varieties of yogic practices appear to affect lung function and are useful in certain psychosomatic respiratory diseases [6 -14]

In today's fast pace life people do not afford to spare more time on doing yogic practices. It was therefore thought to study the effect of TM (only for 20 mins in a day) is effective or not. TM was chosen in the present study as it is the most common form of meditation involving mental repetition of mantra and is easy to learn.

Volunteers were trained for 6 weeks for TM and then this was followed by practicing session of TM for 6 weeks.

Respiratory rate and breath holding time were recorded before and after the training and practicing session and compared.

### Materials and methods

For the present study 75 volunteers were selected. 38 volunteers were females and 37 volunteers were males.

Following criteria were used for selectivity of the volunteers

- Age between 18-45 years
- Intelligent and co-operative subjects likely to adhere to the project program
- No history of heart attacks, hypertension or any other chronic illness that required regular pharmacological treatment.
- No history of major psychological disorders, current alcohol abuse /dependency disorders.
- Each volunteer was explained the whole program and the consent were obtained.

Following parameters were studied in each volunteer at rest and were noted as controlled readings.

- Respiratory rate- One inspiration followed by expiration is considered as one respiratory cycle. Counting of respiratory rate was done with special care because if person becomes conscious of his/her breathing, the respiratory rate changes. To avoid this, attention of the volunteer was distracted by talking with him. Respiratory rate was noted as stated above for three times and average was taken and noted as respiratory rate per minute.
- Breath holding time (Breath holding after full inspiration)- Volunteer was asked to take inspiration and then hold the

breath as long as possible. Breath holding time was noted (in seconds) by using a stopwatch. Volunteer was given practice and then breath holding time was measured three times with rest pauses in between the consecutive tests. Average was noted as breath holding time (in seconds)

- Then volunteers underwent training session for 6 weeks followed by practicing session for 6 weeks.

### Training session

In this session volunteers were trained for Transcendental Meditation.(TM) This is a progressive relaxation technique .It is simple and effective for deep relaxation. Technique was taught by giving individualized personal instructions.

Technique was taught as given below [15, 16, 17, 18]

- Meditator sits quietly in a comfortable position with his/her back erect, eyes closed i.e. (lotus position) and takes slow deep breaths
- Meditator silently repeats a mystical sound (mantra)

Repetition of mantra is supposed to be effortless.Meditator neither attempts to concentrate on sound nor attempts to prevent his/her attention from wavering. There is no need to prevent thoughts during TM. The meditator is instructed merely to 'favour the mantra' and is frequently adjured to take it easily as it comes during the period of instruction. Gradually meditator learns to maintain awareness of mantra excluding other thoughts, external influences and desires.

### Practicing Session

Volunteers practiced TM for 20 minutes every day for 6 weeks.

At the end of practicing session resting respiratory rate and breath holding time were recorded in each individual. The results obtained were compared with control readings .Student's t test was applied for statistical analysis of results.

### Results

There was highly significant reduction in respiratory rate after TM session in both males and females (Table - 1).

*Table - 1 Comparison of Pulse Rate per Minute – Before and After the Session in Males and Females*

Groups		No. of Observations	Mean (x)	S.D.	S.E.	t-value	p-value	Significance
Males	Before	37	16.45	1.038	0.243	26.8	<0.0004	Highly significant
	After	37	10.14	1.052				
Females	Before	38	16.3	1.1358	0.236	26.2	<0.0004	Highly significant
	After	38	10.1	0.8818				

Comparison of results in males and females showed no statistical significant difference indicating that effect of TM on respiratory rate was almost same in males and females (Table - 2)

*Table - 2 Comparison of Respiratory Rate per Minute – in Males and Females*

Groups		No. of Observations	Mean Difference	S.D.	S.E.	t-value	p-value	Significance
Males		37	6.5	1.4	0.314	0.9551	0.337	Not significant
Females		38	6.2	1.3				

There was highly significant increase in breath holding time in both males and females. (Table - 3)

*Table - 3 Comparison of Breath Holding Time (Sec) – Before and After the Session in Males and Females*

Groups		No. of Observations	Mean (x)	S.D.	S.E.	t-value	p-value	Significance
Males	Before	37	50.84	4.99	1.031	12.66	<0.0004	Highly significant
	After	37	63.89	3.80				
Females	Before	38	35.34	5.03	1.110	11.12	<0.0004	Highly significant
	After	38	47.68	4.62				

Comparison of results in males and females showed no statistical difference indicating that effect of TM on breath holding time was almost equal in males and females. (Table - 4)

*Table - 4 Comparison of Breath Holding Time (Sec) – in Males and Females*

Groups		No. of Observations	Mean Difference	S.D.	S.E.	t-value	p-value	Significance
Males		37	13.1	3.6	0.717	1.3939	0.1646	Not significant
Females		38	12.1	2.5				

### Discussion

Results of the present study show that there is significant decrease in respiratory rate after 6 weeks of TM practice. Various workers have studied effect of TM on respiratory rate.

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Many investigators have studied effect of meditation on respiratory rate.

John Allison [11] found significant decrease in respiratory rate during TM. Shirely Tells et al [5] demonstrated decrease in respiratory rate in volunteers mentally repeating a neutral syllable (which according to investigators is equivalent to TM) as compared to other volunteers who repeated meaningful syllable (OM) All volunteers in this study were experienced meditators. According to investigators there is increased neural activity while repeating a non-meaningful syllable.

TM is a wakeful hypo metabolic state characterized by drop in oxygen uptake, carbon dioxide excretion and minute ventilation [19, 20, 6, 21, 14, 22, 23] It also causes reduced sympathetic activity. In a normal person increased sympathetic activity increases the minute ventilation .Therefore reduced sympathetic activity due to practice of TM may be a factor causing reduction in minute ventilation, BMR etc. Decrease in rate of respiration causes reduction in minute ventilation.

I .Sharma, P. Singh [19] have also indicated tranquilizing effect of TM leading to decreased heart rate, decreased metabolism and increased skin resistance.

Paul Christoph et al [24] have studied effect of single session of relaxation in which there is a significant in respiratory rate.

According to R.K.wallace et al [25] during TM there is reduction in total ventilation caused either by decreased frequency or tidal volume.

David Orme Johnson et al [26] has stated that TM technique is a physiological state of restful alertness and it acts by preventing accumulation of physiological stress and indirectly through improved lifestyle leading to balanced physiological functioning. However Sherley Tells et al [3] studied effect of 'OM' meditation on autonomic changes in meditators and found no significant reduction in respiratory rate during meditation.

In the present study therefore significant decrease in respiratory rate can be explained on the basis of altered mental state, reduced sympathetic activity or inhibited neural activity [5] or decreased minute ventilation as explained above. Whatever may be the cause of reduction in respiratory rate which was noted after TM practice it is beneficial as it reduces work of breathing and therefore energy expenditure for tidal respiration.

In the present study there was significant increase in breath holding time in males and females. Comparing the effects in males and females there was no significant difference indicating that change in breath holding time in males and females is almost equal.

Respiratory centre has both voluntary and involuntary control. Therefore respiration can be stopped voluntarily for a short time at any phase of respiratory cycle.

Various factors determine breath holding time

- Size of the alveoli at the time of breath holding [27, 28, 29] i.e. breath holding time depends on initial volume of lung. Breath holding time (BHT) is maximum when one holds the breath after full inspiration. Probably it is due to store of oxygen in the lungs at high lung volume [29]

Break point in breath holding time is due to several reasons. When person holds the breath, repetitive involuntary contractions of respiratory muscles begin early in breath holding. They increase in amplitude and frequency until break point and seem to be responsible for much of discomfort that is felt. These contractions of respiratory muscles activate receptors in the chest wall whose discharge is responsible for the conscious sensation of unpleasantness. Increase in lung volume would lessen the unpleasant sensation. The lower pressure at high lung volume implies that receptors sensitive to pressure in the chest wall, lungs or upper air ways would be less stimulated. Since majority of the activity at high lung volumes is inspiratory muscles, the tension generated due to shortening of these muscles would be less. Muscle and joint receptors affected by tension would be less stimulated when initial lung volume is high.

In the present study BHT after initial full inspiration was determined and therefore this probably is not the reason of increase in BHT observed. It is quite likely that increase in total lung capacity after the session might have caused comparatively increase in lung volume, initial to breath holding and may be a reason for observed increase in BHT. It is observed by Nayar et al [30] that yogic exercises

- Change in the sensitivity of respiratory centre – When breath is held voluntarily, inhibitory impulses from higher centres are able to balance excitatory effects of increased levels of pCO<sub>2</sub>, decreased levels of pO<sub>2</sub> and stimulation of stretch receptors. At the end of breath holding these impulses increase the sensitivity of respiratory centre to such a level that finally voluntary control breaks. TM decreases sympathetic activity which reduces the response of respiratory centre to carbon dioxide [8] This in turn causes increase in breath holding time.

According to A.S. Rebuc et al [31] breathing frequency lower than normal have reduced ventilator response to carbon dioxide which is the cause of increase in breath holding time when respiratory rate is reduced.

- Decrease responsiveness to chemoreceptors- Madanmoham et al [28] found increase in breath holding time in volunteers who did certain asanas for 12 weeks. As a result of yogic training there is decreased responsiveness of medullary and peripheral chemoreceptors which is responsible for increase in BHT.

## Conclusion

In the present study 6 weeks of TM practice caused significant decrease in respiratory rate which in turn reduces energy expenditure of tidal respiration. TM also increases the breath holding time significantly.

Regular practice of TM for 20 minutes would be helpful in increasing respiratory efficiency. This would help in preventing or treating various psychosomatic and other respiratory diseases.

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