

Original Research Article

Study of impact of transcendental meditation on reaction time and cardiovascular parameters in young healthy volunteers

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ABSTRACT

Background: Transcendental meditation technique is purported to help treat high blood pressure, chronic pain, insomnia, and many other physical ailments. The present study was conducted to evaluate the impact of transcendental meditation on reaction time and cardiovascular parameters in young healthy volunteers.

Methods: In this single centre, randomized, controlled study, 120 1st year M.B.B.S and OTPT students were recruited and put into two groups [control (60), experiment (60)]. Simple Auditory Reaction Time (ART) and Visual Reaction Time (VRT), along with Heart Rate (HR) and Blood Pressure (BP), of all subjects were recorded and compared. The experimental group participated in 16 weeks of TM programme and performed TM twice in a day, for 20 minutes, sitting comfortably with eyes closed and chanting OM. Control group were only made to sit with eyes closed during the same time. Keeping all the variables constant, all the parameters were measured again after 16 weeks.

Results: There was significant reduction in all parameters (ART, VRT, HR, systolic BP and diastolic BP) in experimental group after 16 weeks of TM as compared to control group. ART was significantly shorter than VRT in both experimental and control groups and this difference was maintained after the intervention also.

Conclusions: Transcendental meditation is an effective technique for reducing cardiovascular risk and can be prescribed to pre-hypertensive and hypertensive patients for stress reduction, along with medications for better results.

Keywords: Auditory reaction time, Cardiovascular risk, Transcendental meditation, Visual reaction time

INTRODUCTION

The word “meditation” is derived from the Latin “meditari,” which means “to engage in contemplation or reflection.” One of the well-documented concerns confronting scholarly discourse about meditation is the lack of a unified definition and taxonomy. Meditation may broadly be defined as the self-regulation of attention to suspend involvement in the habitual stream of thoughts, with the goal to reach a state of “thoughtless awareness”.¹ Although there are a number of different

techniques, the elements of muscle and ‘logic’ relaxation, self-induced state and self-focused skill are considered essential.¹

The concept of meditation as an object of practical utility from the health perspective has picked up pace over later part of last century. It is being duly adapted to the specific interests and orientation of western culture as a complementary therapeutic strategy for a variety of health-related issues.^{2,3} One behavioral stress reduction approach receiving increasing attention is the

Transcendental Meditation (TM) program. The TM program was originally conceptualized by Maharishi Mahesh Yogi and has its origin in the ancient Vedic approach to health.⁴ The TM technique has been described as a simple, natural procedure practiced for 15 minutes twice a day while sitting comfortably with one's eyes closed. It does not require changes in personal beliefs, lifestyle, or philosophy and hence has higher acceptance worldwide.⁵

Diverse studies from the western countries have reasoned that the TM technique may help treat high blood pressure, chronic pain, insomnia, and many other physical ailments. Despite having origins from India, very few studies have been undertaken in the Indian population. Also, majority of the research has focused on senior, long term TM practitioners, practicing it for more at least 2 years. There is a palpable research gap w.r.t. the young Indian populace. Hence, with the present study, it was decided to explore the benefits of short-term TM practitioners in Indian population, with the specific objective of evaluation of the impact of transcendental meditation on reaction time and cardiovascular parameters in young healthy volunteers.

METHODS

This single centre, randomized, controlled study was conducted at a tertiary care teaching hospital in western India over the period of 16 weeks (June 2009 to September 2009). The study was initiated after necessary approval from the institutional ethics committee and the college management. A total of 120 1st year M.B.B.S & OTPT students were recruited for the study based on following criteria:

Inclusion criteria

- Subjects belonging to age group of 17- 21 years of either gender
- Free from any acute or chronic illness
- Not engaged in regular physical activity

Exclusion criteria

- Current smokers or alcoholic
- Having any auditory or visual illness
- Not willing to consent for participation in the study

The participants were put into two groups of control (60) and experimental (60) using table of random numbers. The subjects were divided into male and female groups, 30 subjects in each group. Each subject was informed of the risks and benefits of the study, made aware of their right to withdraw from the study at any time and asked to sign an institutional approved consent form before enrollment. Each participant was subjected to thorough ophthalmic and ENT examination to rule out any auditory or visual abnormalities. Age, educational and

socioeconomic status, anthropometric measurement of all subjects was recorded.

After basic history and examination, the Reaction Time (RT) was measured using "Techno Digital Response Time" apparatus. Simple Auditory Reaction Time (ART) and Visual Reaction Time (VRT) of all subjects were recorded in morning time in a quiet room, under similar environmental conditions, with the subjects in sitting posture. It was ensured that the subjects did not have tea, coffee or any other stimulants before the test. Red light was used to record simple VRT and high-pitched sound was used for simple ART. After sufficient rehearsals, a set of three reading each of ART and VRT were taken for every participant. The average of the three was considered for statistical analysis. Heart Rate (HR) was recorded using long lead II of ECG. Blood Pressure (BP) was recorded using sphygmomanometer, in supine position, after 5 minutes of rest and average of 3 readings was noted. The experimental group participated in 16 weeks of TM programme and performed TM twice in a day, for 20 minutes, sitting comfortably with eyes closed and chanting OM. Control group were only made to sit with eyes closed during the same time. Keeping all the variables constant, all the parameters were measured again after 16 weeks.

The data were analyzed using Microsoft Excel. Paired t test (2 tailed) was used to compare the parameters before and after intervention. Unpaired t test (unequal variance, 2 tailed) was used to compare the parameters between experimental and control groups. A p- value of <0.05 indicated statistical significance.

RESULTS

The two study groups were comparable with respect to their age (18.55±1.28 years in experimental group vs. 18.15±1.13 years in control group), anthropometric parameters (height- 163.167±7.54 cm in experimental group vs. 161.78±6.955 cm in control group, weight- 59.517±7.14 kgs in experimental group vs. 60.25±6.43 in control group) and socioeconomic status (all were from mid to upper socioeconomic class).

Table 1: Comparison of variables at baseline between experimental and control groups.

Variable	Experimental group (n=60)	Control group (n=60)
ART (seconds)	0.181±0.013	0.1732±0.0154
VRT (seconds)	0.1943±0.018	0.1942±0.0192
Heart rate (beats/minute)	82.72±7.44	79.57±8.5
Systolic BP (mm Hg)	117.43±10.12	116.67±11.2
Diastolic BP (mm Hg)	77.9±7.5	74±8.77

Assessment of parameters at baseline (pre-test) revealed all the mean values to be normal for the age and

statistically comparable between the two groups for each parameter (Table 1).

Table 2: Pre and post-test comparison of variable means across groups.

Variables	Pre-test (mean±sd)	Post-test (mean±sd)	Difference	p-value
Experimental group				
ART (seconds)	0.181±0.013	0.1554±0.011	0.0256	<0.0001
VRT (seconds)	0.1943±0.018	0.1685±0.015	0.0238	<0.0001
Heart rate (beats/minute)	82.72±7.44	72.61±7.42	10.11	<0.0001
Systolic BP (mm Hg)	117.43±10.12	100.2±8.7	17.23	<0.0001
Diastolic BP (mm Hg)	77.9±7.5	66.37±5.34	11.53	<0.0001
Control group				
ART (seconds)	0.1732±0.0154	0.1734±0.0158	0.0002	0.8606
VRT (seconds)	0.1942±0.0192	0.196±0.0197	0.0018	0.16
Heart rate (beats/minute)	79.57±8.5	80.01±8.37	0.44	0.14
Systolic BP (mm Hg)	116.67±11.2	115.64±10.02	1.03	0.24
Diastolic BP (mm Hg)	74.0±8.77	74.4±7.84	0.4	0.636

Table 3: Comparison of variables between experimental and control groups.

Variable	Experimental group (mean±sd)	Control group (mean±sd)	p-value
ART (seconds)	0.0254±0.0146	-0.0002±0.0096	<0.0001
VRT (seconds)	0.0258±0.0147	-0.0018±0.01	<0.0001
Heart rate (beats/minute)	10.1±6.754	-0.45±2.31	<0.0001
Systolic BP (mm Hg)	17.234±7.716	1.034±6.72	<0.0001
Diastolic BP (mm Hg)	11.534±6.307	-0.4±6.512	<0.0001

Table 4: Comparison of ART and VRT amongst study participants.

Study group	ART (in seconds) mean±sd	VRT (in seconds) mean±sd	p value
Pre-test	Experimental	0.181±0.013	0.1943±0.018
	Control	0.1732±0.0154	0.1942±0.0192
Post-test	Experimental	0.1554±0.011	0.1685±0.015
	Control	0.1734±0.0158	0.196±0.0197

Table 5: Comparison of reaction time between males and females.

Variables	Study group	Males	Females	p value
ART (pre-test)	Experimental	0.1765±0.012	0.1854±0.013	0.0085
	Control	0.166±0.014	0.1803±0.0136	0.0002
ART (post-test)	Experimental	0.151±0.009	0.16±0.0125	0.0025
	Control	0.167±0.0155	0.1797±0.0137	0.0015
VRT (pre-test)	Experimental	0.1874±0.017	0.2011±0.0175	0.0035
	Control	0.1893±0.02	0.1989±0.0172	0.05
VRT (post-test)	Experimental	0.1666±0.018	0.174±0.012	0.33
	Control	0.19±0.0193	0.2017±0.0187	0.02

The comparison of means of variables pre- and post- test in experimental group showed significant fall in all the studied parameters with the intervention (16 weeks of TM). On the other hand, sitting with eyes closed sessions

had no significant effects on any of the studied parameters, as seen by comparing pre and post-test values in control group (Table 2). Comparison of the difference between means of parameters using unpaired t test shows

that there is significant reduction in all parameters in experimental group after 16 weeks of TM as compared to control group which underwent eyes closed session (Table 3).

Analysis of reaction times showed that ART was significantly shorter than VRT in both experimental and control groups and this difference was maintained after the intervention also (Table 4).

Both ART and VRT were significantly lesser in males as compared to females in both the groups at baseline. This difference was maintained after intervention, except for post-test VRT which was not significantly different in males and females (Table 5).

DISCUSSION

Transcendental Meditation has always been one of the most enigmatic approaches to positive health. Yet it still remains largely understudied at least in India, which is pitiful given its Indian origin. This compelled us researchers to dwell deeper and study its benefit scientifically. With the present study, the impact of transcendental meditation on reaction time and cardiovascular parameters in young healthy volunteers was studied.

Acute and chronic environmental and psychosocial stress contributes to the pathogenesis and progression of Cardiovascular Diseases (CVD).⁶ Numerous controlled clinical trials have demonstrated that lowering Blood Pressure (BP) reduces morbidity and mortality in the general population. Stress reduction via Transcendental Meditation (TM) has been shown to lower Blood Pressure (BP) levels, Heart Rate and reduce CVD risk in adults and adolescents. In the present study, TM has led to reduction in both systolic and diastolic BP as well as heart rate.

These findings are in line with findings of previous researchers from varied geography and ethnicities.⁷⁻⁹ Schneider et al, however did not find improvement in heart rate, which may be due to shorter duration of practice and older age group.⁷ Maura Paul et al, demonstrated additional benefits in terms of decrease in insulin resistance, which is important from avoidance of development of metabolic syndrome point of view.⁹

So, what leads to reduction in BP and HR? Various mechanisms could be at play and have been proposed and studied: like changes in neurotransmitter balance (increased levels of Serotonin metabolite (increased 5-HIAA Levels); decreased Levels of Adrenaline and Noradrenaline metabolite (decreased VMA Levels) and higher levels of 5-HIAA outside the practice of TM), reduction in biochemical index of stress (decreased plasma Cortisol levels), reduced sympathetic nervous system and hypothalamic-pituitary-adrenocortical axis activation along with more coherent neurophysiologic

functioning and alteration of vasoactive neuropeptide release in the vascular endothelium etc.¹⁰⁻¹³

The practice of TM has been described as altering the thinking process to a more settled state, resulting in a distinctive psycho-physiological state characterized as "restful alertness".¹⁴ Individuals in this state have demonstrated enhanced neurophysiologic function, as observed with this study with reduced reaction time.^{15,16} As a result of TM, considerable decrease (by 30% or more) in the time of a simple motor response and a complex sensorimotor response (due to a decrease in the latent time at constant motor time) and a simultaneous decrease in the number of errors, as well as a considerable increase in the result of the tapping test, were recorded by Son' kin, V et al.¹⁷ The proposed mechanism for this is could be the acceleration of neural conduction or augmentation of release of neurotransmitters and subsequent decrease in synaptic time, resulting in a change in muscle firing threshold and pattern.

Reaction time to auditory stimulus was observed to be less than that to the visual stimulus across genders & this significant difference was observed to be maintained after intervention. This is in conformity with the basic physiology as well as the findings of previous similar works, with the different studies having been conducted across various decades and ethnicities.¹⁷⁻²¹ This particular finding is not in agreement with the study of Shenvi et al, though, who could not achieve the level of significance may be because of relatively small sample size.²²

Reaction times to visual as well as auditory stimuli are faster in the males than in the females and the difference was maintained post-test also, corroborative of findings of similar studies in past.²³⁻²⁵ Botwinick and Thompson reported that almost all of the male-female differences were accounted for by the slow 'Premotor-time' in females. 'Muscle contraction times' (Motor-time) however were the same in both males and females.²³

Kari lahtela et al, suggested that the gender difference in reaction time is task specific. Males are faster in 'Visuospatial' tasks, like detecting a light or sound stimulus and females are faster in 'Semantic' tasks, like recognizing a visually presented digit.²⁵

Two of the major limitations of present study are that the study population belongs to mid-upper socioeconomic strata and 17-21 years age group. Study on general population with larger sample size is recommended to circumvent this shortcoming for better generalizability of the results to other sections of population.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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