

Study of Impact of Meditation on Cardiovascular Functions**Shwetha C Pandomatti¹, Anoop Shastry H², Haninder Sonu³, Afreen Begum H. Itagi⁴**¹Assistant Professor, Department. of Physiology, Subbaiah Institute of Medical Sciences and Research Centre, Shivamogga, Karnataka.²Assistant Professor, Department of Physiology, Subbaih Institute of Medical Sciences and Research Centre, Shivamogga, Karnataka³Senior Resident, Department of Physiology, Subbaiah Institute of Medical Sciences and Research Centre, Shivamogga, Karnataka.⁴Associate Professor, Department of Physiology, All India Institute of Medical Sciences (AIIMS), Mangalagiri, Andhra Pradesh

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Abstract

Meditation produces various effects on human physiology, which are mediated via autonomic nervous system. Meditation is a simple and scientific technique to elicit physical and mental relaxation response, to change one's attitude and transform life-style. Regular practice of it brings transformation in overall wellbeing of person. The cardiovascular morbidity is increasing in India in recent years. 40 healthy volunteers above the age of 30 years and below 65 years performing meditation regularly were included in the study. The same subjects were chosen as both study and control group in order to minimize the confounding factors. Before recording the parameters, the subject was asked to relax physically and mentally for 30 minutes. The blood pressure was recorded with the sphygmomanometer in supine position in the right upper limb by auscultatory method. Similarly, three readings were taken at an interval of 15 minutes each and average of the three values calculated. Heart rate was counted for one minute. The subjects were trained under the guidance of a certified yoga teacher. They carried out meditation for 6 months for 1 hour daily between 6 am and 7 am. The cardiovascular status of each subject, after 6 months of meditation practice was assessed clinically in terms of blood pressure and heart rate recordings. Statistical analysis was done by t test. The results of this study demonstrated a reduction in Heart rate, systolic blood pressure, diastolic blood pressure indicating parasympathetic nervous system dominance during & immediately after meditation.

Keywords: Meditation, Blood Pressure, Heart Rate.

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Introduction

“Meditation” is a set of attentional practices leading to an altered state or trait of consciousness characterized by expanded awareness, greater presence, and a more integrated sense of self. Practice of concentrating focus on an imaginary point on forehead (between eyebrows), sound or object increase awareness of the present moment, reduce stress, promote relaxation, and enhance personal and spiritual growth. Meditation practice self-regulates the body and mind, thereby affecting mental events by engaging into a specific attentional set. These practices are a subset of other practices used to induce relaxation or altered states such as hypnosis, progressive relaxation and trance-induction techniques [1]. Meditation is a simple mental technique which has well documented benefits for health and wellbeing [2,3]. It can be learned easily by anyone regardless of age, educational background, or culture. The

technique is effortless and requires no belief or any change in lifestyle or diet. During Meditation mental activity settles down in a natural way, while alertness is maintained and even enhanced. Meditation produces a specific physiological response pattern that involves various biological systems. Mechanism most frequently suggested that meditation produces effects including metabolic, autonomic, endocrine, neurological, cardiovascular and psychological responses on a multidimensional interactive basis.

Meditation is a complex phenomenon that involves several coordinated, cognitive processes and autonomic nervous system alterations. Meditation as a form of therapy may facilitate positive effect resulting in a sense of physical and mental well being in patients [4]. Meditation has entered the mainstream of health care as a method of stress and pain reduction. In the recent years there has been a

growing interest within the medical community to study the physiological effects of meditation [5-8]. Meditation is recognised as a calm state of mind with parasympathetic dominance in the body. Regular meditators may experience a calm & hypo-metabolic state with parasympathetic dominance. Some studies show beneficial effects in controlling blood pressure in hypertensives. The meditation is the method of extending our ordinary consciousness and thereby discovering more about ourselves. When we gain this insight, we can change our habits and our deeper, inner personality has a better chance to show through. Our whole life changes for the better. Meditation is the technique of turning down the brilliance of the day so that the subtle sources of energy can be perceived within. Meditation has always been a subject of intense exploration amongst scientists. It has been stressed that the physiology of meditation differs from that of ordinary rest with eyes closed and from that of most hypnotic states. Further, during meditation, deep physiological relaxation, somewhat similar to that occurring in the "deepest" non-rapid-eyemovement (NREM) sleep phase occurs in a context of wakefulness [9]. Wallace et al., termed meditation a "wakeful, hypometabolic state of parasympathetic dominance" [10]. A vast complexity of biological organization indicates that the physiological response to meditation probably occurs on a multidimensional, interactive basis. Further, meditation produces specific neural activation patterns involving decreased limbic arousal in the brain, which in turn results in reduced stress and increased autonomic stability. Role of different clinical reflexes to assess functions of autonomic nervous system in clinical conditions like borderline hypertension has been documented [11]. Meditation practices mainly

change body functions through Autonomic nervous system, which links brain and body. It is achieved by exercising the techniques like meditation, yoga, pranayam. Yoga is best lifestyle modification which aims to attain the unity of mind body and spirit. [12] Concentrative meditation focuses the attention on the breath. Breath is a dynamic bridge between the body and mind. [13,14] Present study was aimed to assess the effect of meditation on blood pressure and heart rate.

Materials and Methods

The study was conducted in Medical college. 40 healthy volunteers above the age of 30 years and below 65 years performing meditation regularly were included in the study. All the volunteers were clinically examined to rule out any systemic diseases. The study protocol was explained to the subjects and written consent was obtained. The same subjects were chosen as both study and control group in order to minimize the confounding factors. Before recording the parameters, the subject was asked to relax physically and mentally for 30 minutes. The blood pressure was recorded with the sphygmomanometer in supine position in the right upper limb by auscultatory method. Similarly, three readings were taken at an interval of 15 minutes each and average of the three values calculated. Heart rate was counted for one minute. The subjects were trained under the guidance of a certified yoga teacher. They carried out meditation for 6 months for 1 hour daily between 6 am and 7 am. The cardiovascular status of each subject, after 6 months of meditation practice was assessed clinically in terms of blood pressure and heart rate recordings. Statistical analysis was done by t test.

Results

Table 1: Blood Pressure and Heart Rate before and after Meditation Practice

HR and BP	Before Meditation Practice (n = 40) mean ± SD	After 6 months of Meditation Practice (n = 40) mean ± SD	p value
Heart Rate (bpm)	80.35±3.8	70.48±2.4	<0.01
Systolic Blood pressure (mmHg)	132.46±8.34	122.6±6.2	<0.01
Diastolic Blood pressure (mmHg)	84.4±6.2	76.4±4.36	<0.01

Results show reduction in heart rate, blood pressure after 6 months of regular practice of meditation. This difference in blood pressure, heart rate before and after meditation practice was statistically highly significant $p < 0.01$

Discussion

The significant decrease in heart rate, blood pressure, after meditation practice in present study is in accordance with findings of other studies on physiological effect of meditation practice in healthy individuals. [15] The present study

revealed a significant decrease in heart rate after 6 months of meditation is suggestive of psychophysiological relaxation. In present study a highly significant reduction in heart rate, systolic and diastolic pressure can be attributed to modulation of autonomic activity with parasympathetic predominance and relatively reduced sympathetic tone. This autonomic modulation in yoga is mediated through modification of breathing which triggers central and autonomic mechanism and hemodynamic adjustments. [16] Meditation by modifying state of

anxiety reduces stress induced sympathetic over activity, thereby decreasing arterial tone and peripheral resistance resulting in lowering of diastolic blood pressure and heart rate. [17] By practicing meditation for few weeks, the bulbopontine complex is adjusted to a new pattern of breathing which is slower than basal rhythm causing decrease in respiratory rate. [18] The mean values of heart rate, systolic blood pressure and diastolic blood pressure are highly significant reduction after 4 months of meditation practice. Reduction in heart rate and blood pressure indicate a shift in the balancing components of autonomic nervous system towards the parasympathetic activity which was reported by Santha Joseph et al., [19] and Anand BK et al., [20]. This modulation of autonomic nervous system activity might have been brought about through the conditioning effect of meditation on autonomic functions and mediated through the limbic system and higher areas of central nervous system was reported by Selvamurthy et al., [21]. Regular practice of meditation increases the baroreflex sensitivity and decreases the sympathetic tone, thereby restoring blood pressure to normal level in patients of essential hypertension was reported by Vijaya Lakshmi et al., [22]. Some research shows an elevated beta-endorphin levels in persons doing regular meditation that may be responsible for relaxed & calm state of regular meditators & it also boost immunity. Further researches are undergoing in meditation physiology to unearth rest of the benefits. Many studies have examined the effect of meditation on heart health. Regular meditation practice has been shown to help lower high blood pressure in the long run. Among these studies, one study showed a sharp drop in blood pressure and heart rate in black adults. Another study found that teens who meditate twice a day for 15 minutes each time for four months can lower their blood pressure up to several digits [23,24]. The sympathetic nervous system dilates the pupil and raises blood pressure and respiration rate. Meditation works the other way around, lowering blood pressure and muscle tension. This article shows that meditation is an influential factor in reducing heart rate, increasing concentration, and reducing anxiety and stress. Therefore, since meditation is a simple and low-cost method, meditation exercises can be one of the most common problems for people and Reduced heart disease. As a result, using meditation by regulating heart rate reduces mental fatigue and improves performance.

Conclusion

Meditation, by modifying the state of anxiety, reduces stress induced sympathetic overactivity, resulting in the lowering of the DBP and the HR. It makes the person relaxed and thus decreases the arterial tone and the peripheral resistance. During

meditation, meditator brings the mind to a pointed focus which could be the person's breath or a single object, which in turn reduces the thoughts in mind and hence reduces sympathetic activity. This results in the reduction in HR and vasodilatation which in turn reduces total peripheral resistance. Hence, meditation helps to improve cardiovascular efficiency and homeostatic control of the body. The results of this study demonstrated a reduction in systolic blood pressure, diastolic blood pressure indicating parasympathetic nervous system dominance during & immediately after meditation.

References

1. Vaitl D, Birbaumer N, Gruzelier J, Jamieson GA, Kotchoubey B, Kubler A. Psychobiology of altered states of consciousness. *Psychological Bulletin*. 2005; 131: 98–127.
2. Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Programme: Collected Papers. Maharishi Vedic University Press, Holland. 1-6.
3. Orme-Johnson DW. Medical care utilization and the Transcendental Meditation program. *Psychosomatic Medicine*. 1987; 49: 493–507.
4. I. Sharma, R. Meditation and mental well-being. *Indian journal of physiology and pharmacology*, 2006;50(3): 205-214.
5. Peng, C. K., Mietus, J. E., Liu, Y., Khalsa, G., Douglas, P. S., Benson, H., & Goldberger, A. L. Exaggerated heart rate oscillations during two meditation techniques. *International journal of cardiology*, 1999; 70(2): 101-107.
6. Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S. F., ...& Sheridan, J. F. Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic medicine*, 2003; 65(4): 564-570.
7. Kabat-Zinn, J., Lipworth, L., & Burney, R. The clinical use of mindfulness meditation for the self-regulation of chronic pain. *Journal of behavioral medicine*, 1985; 8(2): 163-190.
8. Carlson, L. E., Ursuliak, Z., Goodey, E., Angen, M., & Speca, M. The effects of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients: 6-month follow-up. *Supportive care in Cancer*, 2001; 9(2): 112-123.
9. Brown, S. W., & Blodgett, J. EEG Kappa rhythms during Transcendental meditation and possible perceptual threshold changes. In: D Kanellakos editor. *The Psychobiology of Transcendental meditation: A Literature Review*. Menlo Park (California): WA. Benjamin. 1974.
10. Wallace, R. K., Benson, H., & Wilson, A. F. (1971). A wakeful hypometabolic physiologic

- state. American Journal of Physiology-Legacy Content, 1071; 221(3): 795-799.
11. Mahajan, S. K., Mahajan, K. K., & Gupta, J. P. Autonomic reflexes in borderline hypertensives. The Journal of the Association of Physicians of India, 1990;38(10): 784-786.
 12. Berad A, Lakshmi A, Sneha P, Effect of OM meditation on autonomic functions in healthy young individuals. Indian J Clin Anat Physiol. 2017;4(2):263-265
 13. 13.Iyenger BKS.7th edition. New Delhi: harpercollins publishers; Light on yoga. 2002.
 14. Bijlani R.L. 3rd edition. New Delhi: Jaypee brothers; Understanding medical physiology; 2004; 871-910.
 15. 15.Bharshankar J R, Bharshankar RN, Deshpande VN. Effect of yoga on CV Sin Indian J Physiol. Pharmacol. 2003;47:202-6.
 16. 16. Raghuraj P, Ramakrishnan AG, Nagendra HR. Effect of 2 selected yogic technique on HR variability. Indian J Physiol Pharmacol 1998; 42:467-72.
 17. 17. Vyas R, Dikshit. N. Effect of meditation on respiratory system, cardiovascular system. Indian J. Physiol Pharmacol. 2002; 46:487-91.
 18. 18. Doijad V, Surdi A. Effect of short-term yoga practice on cardiorespiratory fitness parameters. Int J Basic Med Sci. 2012;3(5):38-41.
 19. 19. Anand, B. K. Yoga and medical sciences. Indian J Physio Pharmacol, 1991; 35(2): 84-87.
 20. 20. Selvamurthy, W., Nayar, H. S., Joseph, N. T., & Joseph, S. Physiological effects of yogic practice. Nimhans journal, 1983; 1(1): 71-80.
 21. 21. Vijayalakshmi, P., Madanmohan, B. A., Patil, A. S. M. I. T. A., & Babu, K. Modulation of stress induced by isometric handgrip test in hypertensive patients following yogic relaxation training. Indian J Physiol Pharmacol, 2004; 48(1): 59-64.
 22. 22.Harte, J. L., Eifert, G. H., & Smith, R. The effects of running and meditation on betaendorphin, corticotropin-releasing hormone and cortisol in plasma, and on mood. Biological Psychology, 1995; 40(3): 251-265.
 23. 23. Paholpak S, Piyavhatkul N, Rangseekajee P, Krisanaparakornkit T, Arunpongpaissal S, et al. Breathing meditation by medical students at KhonKaen University: effect on psychiatric symptoms, memory, intelligence. 2012.
 24. 24.Shilpa M, Tejaswini KS, Raghunandana R, Narayana K, Marigowda S. Effects of meditation compared with effects of meditation with autosuggestion on cardiovascular variables and autonomic functions – An analytical study. Natl J Physiol Pharm Pharmacol. 2020;10(06):484-487.