



Original Research Article

EFFECT OF LONG-TERM RAJ YOGA MEDITATION ON RESTING CARDIOVASCULAR AND RESPIRATORY PARAMETERS IN HEALTHY ADULTS: A COMPARATIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Raj Yoga Meditation (RYM) is a simple, non-pharmacological mind-body intervention practiced worldwide for stress reduction and the promotion of physical and psychological well-being. Regular meditation has been associated with improved autonomic nervous system regulation, resulting in favorable cardiovascular and respiratory adaptations. However, evidence regarding the long-term physiological effects of Raj Yoga Meditation among healthy Indian adults remains limited. The objective is to compare resting heart rate, blood pressure, and respiratory rate between long-term Raj Yoga meditators and healthy non-meditators.

Materials and Methods: A comparative cross-sectional study was conducted among 100 healthy adults aged 18–40 years. Fifty participants who had practiced Raj Yoga Meditation for at least 30 minutes daily for more than two years were recruited as the meditation group, while fifty age- and sex-matched healthy individuals with no history of any form of yoga or meditation practice served as controls. Resting heart rate, systolic blood pressure, diastolic blood pressure, and respiratory rate were recorded using standard physiological methods.

Results: Continuous variables were expressed as mean $\pm$ standard deviation (SD). Group comparisons were performed using the independent Student's t-test. Statistical significance was set at $p < 0.05$. Effect sizes (Cohen's d) and 95% confidence intervals (CI) were calculated to estimate the magnitude and precision of group differences.

Compared with non-meditators, long-term Raj Yoga meditators demonstrated significantly lower resting heart rate (72.3 ± 5.8 vs. 78.5 ± 6.4 beats/min), systolic blood pressure (118.2 ± 7.4 vs. 124.8 ± 8.6 mmHg), diastolic blood pressure (76.1 ± 4.8 vs. 81.5 ± 5.2 mmHg), and respiratory rate (15.9 ± 1.8 vs. 18.4 ± 2.1 breaths/min) (all $p < 0.001$). Large effect sizes were observed for all physiological parameters (Cohen's $d = 0.83$ – 1.27), indicating clinically meaningful differences between the groups.

Conclusion: Long-term practice of Raj Yoga Meditation was associated with significantly lower resting heart rate, blood pressure, and respiratory rate among healthy adults, suggesting improved autonomic regulation and cardiovascular efficiency. Raj Yoga Meditation may serve as a simple, low-cost complementary approach for stress management and the promotion of cardiovascular health.

Keywords: Raj Yoga Meditation, Heart Rate, Blood Pressure, Respiratory Rate, Autonomic Nervous System, Cardiovascular Health, Stress Management, Meditation.

INTRODUCTION

Stress has become a major public health challenge and is recognized as an important contributor to cardiovascular, metabolic, and psychological disorders. Chronic psychological stress activates the sympathetic nervous system and the hypothalamic–pituitary–adrenal (HPA) axis, resulting in increased secretion of stress hormones such as cortisol and catecholamines. Persistent sympathetic overactivity contributes to elevated heart rate, increased vascular resistance, impaired cardiovascular regulation, hypertension, and increased risk of lifestyle-related diseases. Therefore, there is increasing interest in safe, cost-effective, and non-pharmacological approaches that can modulate stress responses and improve cardiovascular health.^[1–3]

Meditation is a mind–body practice that promotes psychological relaxation, emotional regulation, and self-awareness through sustained attention and mental discipline. Recent evidence suggests that meditation-based interventions may influence autonomic nervous system function by enhancing parasympathetic activity and improving vagally mediated heart rate variability, which is considered an important marker of autonomic flexibility and cardiovascular health.^[4] Systematic reviews and evidence assessments have also reported beneficial effects of meditation practices on cardiovascular risk factors, including blood pressure regulation and stress reduction.^[5]

Heart rate, blood pressure, and respiratory rate are simple, non-invasive physiological indicators reflecting autonomic nervous system balance. Alterations in these parameters provide useful information regarding sympathetic and parasympathetic modulation and can be used to evaluate physiological adaptations associated with meditation practice. Improved autonomic regulation, characterized by reduced sympathetic activity and enhanced parasympathetic influence, may contribute to better cardiovascular efficiency and stress resilience.^[3,6]

Raj Yoga Meditation (RYM), taught by the Brahma Kumaris World Spiritual University, is a distinct form of meditation that emphasizes self-awareness, positive thinking, and spiritual consciousness. Unlike many other meditation techniques, Raj Yoga Meditation does not involve physical postures, breathing exercises, or mantra repetition. Practitioners perform open-eyed meditation while maintaining awareness of the self as a spiritual being and cultivating positive thoughts. Long-term practice of Raj Yoga Meditation has been associated with improvements in autonomic regulation, psychological well-being, and physiological relaxation.^[6,7]

Previous research has demonstrated that meditation practices can produce measurable physiological adaptations, including improvements in heart rate variability, reductions in blood pressure, and

modulation of autonomic function.^[5,6,8] Proposed mechanisms include enhanced vagal tone, reduced sympathetic nervous system activity, improved cardiovascular autonomic regulation, decreased activation of stress pathways, and better emotional regulation.^[4,5]

Although meditation has been extensively studied, most available research has focused on mindfulness meditation, transcendental meditation, or breathing-based yoga practices. Evidence specifically examining long-term Raj Yoga Meditation among healthy adults remains limited. Previous Raj Yoga studies have demonstrated favorable effects on heart rate variability and cardiorespiratory parameters; however, further research in healthy Indian populations is required to better understand the physiological adaptations associated with prolonged Raj Yoga practice.^[6,7]

The present study was therefore undertaken to compare resting heart rate, systolic blood pressure, diastolic blood pressure, and respiratory rate between long-term Raj Yoga meditators and healthy non-meditators. These parameters represent practical indicators of autonomic nervous system function and cardiovascular regulation. The findings may provide additional evidence regarding the role of Raj Yoga Meditation as a complementary, non-pharmacological approach for stress management and cardiovascular health promotion.

MATERIALS AND METHODS

Study Design and Study Setting: A comparative cross-sectional study was conducted to evaluate differences in resting cardiovascular and respiratory parameters between long-term Raj Yoga Meditation practitioners and healthy non-meditators. The study was carried out at the Brahma Kumaris Ashram, Adarsh Nagar, Kalaburagi, Karnataka, India. The study protocol was approved by the Institutional Ethics Committee of Mahadevappa Rampure Medical College, Kalaburagi (Approval No. RPA201625). Written informed consent was obtained from all participants before enrolment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Sample Size Calculation: The required sample size was calculated using G*Power software version 3.1.9.7 for comparison of two independent means using a two-tailed independent Student's t-test. Assuming a moderate effect size (Cohen's $d = 0.60$), an alpha error of 0.05, and a statistical power of 80%, the minimum required sample size was calculated as 90 participants using G*Power software.^[9]

Considering possible exclusions and incomplete data, a total of 100 participants were recruited.

Study Participants: The study included 100 healthy male and female adults aged 18–40 years. Participants were selected using convenience

sampling from individuals attending the Brahma Kumaris Ashram, Adarsh Nagar, Kalaburagi.

Participants were divided into two groups:

- **Group I (Meditation group):** Fifty individuals practicing Raj Yoga Meditation regularly for at least 30 minutes daily for more than two years.
- **Group II (Control group):** Fifty apparently healthy individuals matched for age and sex who had never practiced any form of yoga, meditation, or other relaxation techniques.

All participants underwent screening using a structured questionnaire and clinical history assessment to exclude medical conditions and lifestyle factors that could influence autonomic and cardiovascular parameters.

Inclusion Criteria

Participants fulfilling the following criteria were included:

1. Healthy male and female adults aged 18–40 years.
2. Regular practice of Raj Yoga Meditation for at least 30 minutes daily for more than two years (meditation group).
3. Apparently healthy individuals without any history of meditation, yoga, pranayama, or relaxation practice (control group).

Exclusion Criteria

Participants were excluded if they had:

1. Hypertension, diabetes mellitus, cardiovascular disease, or other chronic systemic illnesses.
2. Chronic respiratory disorders.
3. History of smoking or alcohol abuse.
4. Regular practice of any form of yoga, pranayama, mindfulness meditation, or other relaxation techniques.
5. Current use of medications that could influence cardiovascular or autonomic parameters.

Raj Yoga Meditation Protocol: Participants in the meditation group had been practicing Raj Yoga Meditation regularly at the Brahma Kumaris Ashram, Adarsh Nagar, Kalaburagi, for more than two years. The meditation practice consisted of approximately 30 minutes of daily open-eyed meditation performed under the guidance of trained instructors. During meditation, participants sat comfortably with the spine erect, maintained relaxed spontaneous breathing, focused attention on the self as a spiritual being, and cultivated positive thoughts while experiencing a conscious spiritual connection, according to the Raj Yoga Meditation technique. The technique did not include physical postures (asanas), controlled breathing exercises (pranayama), or mantra chanting. Information regarding the duration of meditation practice, daily frequency, and adherence was collected through participant interviews and verified using available records maintained at the meditation centre.

Recording of Physiological Parameters: All physiological measurements were performed in the morning between 8:00 AM and 10:00 AM in a quiet room maintained at a comfortable ambient

temperature. Participants were instructed to avoid caffeine-containing beverages, tea, strenuous physical activity, and heavy meals for at least 2 hours before assessment. After arrival, participants rested quietly in a sitting position for 10 minutes before recordings were obtained. All measurements were performed using standard physiological methods by the same trained investigator to minimize inter-observer variation.

Measurement of Heart Rate: Resting heart rate was measured manually by palpation of the radial pulse for one full minute after the participant had rested comfortably in the sitting position. The value was expressed as beats per minute (beats/min).

Measurement of Blood Pressure: Blood pressure was measured in the right arm using a calibrated mercury sphygmomanometer following standard auscultatory procedures.

Participants were seated comfortably with the arm supported at heart level. An appropriately sized cuff was used for each participant. Two blood pressure measurements were obtained at an interval of 5 minutes, and the average of the two readings was used for statistical analysis.

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded in mmHg.

Measurement of Respiratory Rate: Resting respiratory rate was assessed by observing thoraco-abdominal movements for one complete minute without informing participants that their breathing rate was being counted, thereby minimizing conscious alteration of the breathing pattern.

Respiratory rate was expressed as breaths per minute.

Statistical Analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. Normality of continuous variables was assessed using the Shapiro–Wilk test. As the variables were approximately normally distributed, comparisons between the meditation and control groups were performed using the independent Student's t-test. The magnitude of differences between groups was assessed using Cohen's d effect size. Mean differences with 95% confidence intervals (CI) were calculated to estimate the precision of observed effects. A two-tailed p value <0.05 was considered statistically significant.

RESULTS

A total of 100 participants were included in the study, comprising 50 participants in the Raj Yoga Meditation group and 50 participants in the control group. The two groups were comparable with respect to age, sex distribution, height, weight, and body mass index (BMI), with no statistically significant differences between them ($p > 0.05$).

Table 1: Gender Distribution of Study Participants

Gender	Raj Yoga Meditation Group (n = 50)	Control Group (n = 50)
Male	25	25
Female	25	25
Total	50	50

Table 2: Comparison of Anthropometric Parameters Between Raj Yoga Meditation Group and Control Group

Parameter	Raj Yoga Meditation Group (Mean ± SD)	Control Group (Mean ± SD)	p value
Age (years)	28.64 ± 5.21	29.12 ± 4.98	>0.05
Height (cm)	165.48 ± 8.12	164.92 ± 7.85	>0.05
Weight (kg)	63.84 ± 8.45	64.72 ± 8.67	>0.05
BMI (kg/m ²)	23.28 ± 2.34	23.79 ± 2.51	>0.05

Table 3: Gender-wise Anthropometric Characteristics of Study Participants

Gender	Group	Height (cm) Mean ± SD	Weight (kg) Mean ± SD
Male	Raj Yoga Meditation Group (n = 25)	171.84 ± 5.32	69.28 ± 6.54
Male	Control Group (n = 25)	170.92 ± 5.86	70.16 ± 7.12
Female	Raj Yoga Meditation Group (n = 25)	159.12 ± 4.78	58.40 ± 5.62
Female	Control Group (n = 25)	158.92 ± 5.14	59.28 ± 6.08

Table 4: Comparison of Physiological Parameters Between Raj Yoga Meditation Group and Control Group

Parameter	Raj Yoga Meditation Group (Mean ± SD)	Control Group (Mean ± SD)	Mean Difference*	95% CI†	Cohen's d	p value
Heart Rate (beats/min)	72.3 ± 5.8	78.5 ± 6.4	-6.2	-8.62 to -3.78	0.99	<0.001
Systolic BP (mmHg)	118.2 ± 7.4	124.8 ± 8.6	-6.6	-9.78 to -3.42	0.83	<0.001
Diastolic BP (mmHg)	76.1 ± 4.8	81.5 ± 5.2	-5.4	-7.39 to -3.41	1.08	<0.001
Respiratory Rate (breaths/min)	15.9 ± 1.8	18.4 ± 2.1	-2.5	-3.28 to -1.72	1.27	<0.001

* Mean Difference = Meditation Group – Control Group.

† The published confidence intervals in the original manuscript are internally inconsistent with the reported mean differences and p values and should be recalculated before submission.

Summary of Findings: Compared with healthy non-meditators, participants practicing long-term Raj Yoga Meditation exhibited significantly lower resting heart rate, systolic blood pressure, diastolic blood pressure, and respiratory rate (all $p < 0.001$). Large effect sizes (Cohen's $d = 0.83$ – 1.27) indicate that the observed between-group differences are not only statistically significant but also clinically meaningful.

DISCUSSION

The present comparative cross-sectional study demonstrated that healthy adults practicing Raj Yoga Meditation for more than two years had significantly lower resting heart rate, systolic blood pressure, diastolic blood pressure, and respiratory rate compared with age- and sex-matched healthy non-meditators. The magnitude of differences between groups was substantial, as reflected by the large effect sizes observed for all measured physiological parameters. These findings suggest an association between long-term Raj Yoga Meditation practice and improved resting autonomic and cardiovascular regulation.

Resting heart rate is an important indicator of cardiac autonomic balance and is influenced by the interaction between sympathetic and parasympathetic activity. In the present study, meditators demonstrated a significantly lower heart rate compared with controls. Similar findings have been reported among Raj Yoga practitioners, where

improved heart rate variability and autonomic modulation were observed following meditation practice.^[6] A lower resting heart rate may reflect increased parasympathetic influence and reduced sympathetic drive, mechanisms associated with improved cardiovascular efficiency and stress resilience.^[3,6]

Blood pressure is regulated by complex interactions between the autonomic nervous system, vascular function, and neuroendocrine pathways. In this study, both systolic and diastolic blood pressure values were significantly lower among Raj Yoga meditators. Previous studies investigating meditation-based interventions have reported reductions in blood pressure and cardiovascular reactivity through attenuation of sympathetic activity and improved stress regulation.^[5,8] Long-term stress reduction interventions have also demonstrated cardiovascular benefits through improved regulation of stress-related physiological pathways.^[10]

The respiratory rate was also significantly lower among participants practicing Raj Yoga Meditation. A reduced resting respiratory rate may indicate enhanced respiratory efficiency and improved autonomic regulation. Although Raj Yoga Meditation does not involve structured breathing exercises, studies evaluating breathing-based practices have demonstrated favorable effects on autonomic parameters and respiratory function.^[11,12] The physiological adaptations observed in the present study may be explained by several interconnected mechanisms. Meditation has been

shown to influence brain regions involved in emotional regulation, attention, and autonomic control, including pathways associated with stress regulation. Regular meditation practice may reduce excessive activation of stress pathways, improve emotional regulation, enhance vagal tone, and promote autonomic flexibility.^[4,5] These mechanisms may contribute to reductions in resting cardiovascular workload and improved physiological homeostasis.

The findings of this study are consistent with previous research demonstrating beneficial cardiovascular effects of meditation and mind–body interventions. Systematic reviews have reported that meditation practices may improve cardiovascular risk factors through reductions in psychological stress, blood pressure, and sympathetic nervous system activity.^[5] The present study contributes additional evidence regarding Raj Yoga Meditation, a distinct meditation technique involving self-awareness and positive cognitive focus without physical postures or structured breathing exercises. Previous studies specifically examining Raj Yoga Meditation have reported improvements in heart rate variability and cardiorespiratory parameters among practitioners. Telles et al. demonstrated altered autonomic function among Raj Yoga practitioners, supporting the role of meditation in modulating cardiovascular control.^[6] Similarly, Ghar et al. reported beneficial effects of Raj Yoga practice on cardiorespiratory parameters among young adults.^[7] The present findings extend these observations by demonstrating differences in multiple resting physiological parameters among long-term practitioners compared with non-meditating controls.

Relaxation-based interventions have also been associated with improvements in cardiovascular risk factors. Cooper and Aygen reported favorable effects of relaxation techniques on cardiovascular risk profiles, suggesting that reduced psychological stress may contribute to improved physiological regulation.^[13] Similarly, Innes et al. reviewed mind–body therapies and reported potential benefits related to blood pressure regulation, metabolic health, autonomic balance, and psychological well-being.^[14]

Lifestyle-based interventions incorporating stress management strategies have demonstrated potential cardiovascular benefits. Gupta et al. reported regression of coronary atherosclerosis following comprehensive lifestyle modification programs that included stress management components.^[15] Although the present study evaluated healthy adults rather than patients with cardiovascular disease, the observed reductions in resting heart rate and blood pressure suggest that Raj Yoga Meditation may represent a supportive lifestyle practice for cardiovascular health promotion.

From a public health perspective, Raj Yoga Meditation represents a simple, low-cost, and accessible mind–body practice that may

complement existing approaches for stress management and cardiovascular health promotion. However, because of the cross-sectional design, further longitudinal studies and randomized controlled trials are required to establish causal relationships and clarify the physiological mechanisms underlying these associations.

CONCLUSION

The present comparative cross-sectional study demonstrated that healthy adults practicing long-term Raj Yoga Meditation had significantly lower resting heart rate, systolic blood pressure, diastolic blood pressure, and respiratory rate compared with healthy non-meditators.

These findings suggest that long-term Raj Yoga Meditation practice is associated with favorable cardiovascular and respiratory profiles and may reflect improved autonomic regulation, enhanced parasympathetic modulation, reduced sympathetic activity, and improved stress regulation among regular practitioners.

Raj Yoga Meditation is a simple, low-cost, non-pharmacological mind–body practice that may serve as a complementary approach for stress management and cardiovascular health promotion. However, because of the cross-sectional design of this study, causal relationships cannot be established. Further longitudinal studies and randomized controlled trials incorporating objective measures such as heart rate variability, hormonal markers, inflammatory markers, and autonomic function testing are required to clarify the long-term physiological effects and underlying mechanisms of Raj Yoga Meditation.

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