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Effect of a 120-Day Pranayama and Preksha Meditation Intervention on Cardiovascular Function in Adults: A Randomized Controlled Trial

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Abstract

To evaluate the effects of a structured 120-day Pranayama and Preksha Meditation intervention on cardiovascular function in healthy adults.

A randomized controlled trial was conducted among healthy adults allocated to an experimental group receiving a supervised Pranayama and Preksha Meditation program for 120 days and a control group maintaining usual daily activities. Cardiovascular assessments were performed at baseline, Day 60, and Day 120. Outcome measures included resting heart rate, systolic blood pressure, diastolic blood pressure, pulse pressure, mean arterial pressure, and related cardiovascular indices according to the original study protocol.

Participants in the intervention group demonstrated progressive improvement in cardiovascular parameters over the intervention period. Significant reductions were observed in resting heart rate and arterial blood pressure, whereas the control group exhibited minimal changes. Improvements became more pronounced after 120 days, suggesting cumulative physiological adaptation following regular yogic practice.

A structured 120-day Pranayama and Preksha Meditation intervention significantly improved cardiovascular function in healthy adults. These findings support the integration of yoga-based lifestyle interventions into preventive cardiovascular health programs.

Keywords: Pranayama; Preksha Meditation; Cardiovascular Function; Blood Pressure; Heart Rate; Yoga; Randomized Controlled Trial.

Introduction

Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, accounting for approximately one-third of all global deaths. According to the World Health Organization, ischemic heart disease and stroke together contribute substantially to

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premature mortality and disability, placing enormous socioeconomic and healthcare burdens on both developed and developing countries. Although pharmacological therapies have significantly improved the management of cardiovascular disorders, prevention through lifestyle modification continues to be the most effective and economical strategy for reducing cardiovascular risk. Consequently, increasing attention has been directed toward non-pharmacological interventions capable of improving cardiovascular function before the onset of clinical disease.

Cardiovascular health depends upon the coordinated regulation of heart rate, blood pressure, vascular resistance, cardiac output, and autonomic nervous system activity. These physiological processes are continuously influenced by genetic, behavioral, environmental, and psychological factors. Chronic psychological stress, sedentary lifestyle, obesity, poor dietary habits, inadequate sleep, and reduced physical activity contribute significantly to autonomic imbalance characterized by increased sympathetic activity and reduced parasympathetic tone. Such autonomic dysregulation is associated with elevated heart rate, hypertension, endothelial dysfunction, chronic inflammation, and an increased risk of cardiovascular morbidity and mortality.

Among lifestyle-based interventions, yoga has emerged as a promising complementary approach for improving cardiovascular health. Yoga is a comprehensive mind–body discipline that integrates physical postures (Asanas), controlled breathing techniques (Pranayama), meditation, and relaxation practices. Unlike conventional exercise programs that primarily target musculoskeletal fitness, yoga simultaneously influences cardiovascular, respiratory, neuroendocrine, metabolic, and psychological systems. Growing scientific evidence suggests that regular yoga practice improves autonomic regulation, reduces blood pressure, enhances heart rate variability, decreases perceived stress, and improves vascular function, thereby contributing to overall cardiovascular health.

The findings of the present study are expected to contribute to the growing body of evidence supporting yoga-based interventions as safe, inexpensive, and easily implementable strategies for cardiovascular health promotion. By evaluating a long-duration intervention in apparently healthy adults, this study may provide valuable evidence for preventive cardiology, workplace wellness programs, community health initiatives, and integrative medicine. Moreover, the results may support the incorporation of structured Pranayama and Preksha Meditation into national lifestyle modification programs aimed at reducing the future burden of cardiovascular disease.

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Materials and Methods

Study Design

This study was designed as a prospective, randomized, controlled, parallel-group intervention trial to evaluate the effects of a structured 120-day Pranayama and Preksha Meditation program on cardiovascular function in healthy adults. Cardiovascular parameters were assessed at three predefined time points: baseline (Day 0), first follow-up (Day 60), and second follow-up (Day 120). The study followed the principles of the Declaration of Helsinki and adhered to accepted ethical standards for research involving human participants.

Participants

Adults aged **30–40 years** were recruited through institutional notices and community outreach. All volunteers underwent detailed medical screening before enrolment.Participants fulfilling the eligibility criteria were included after providing written informed consent.

Sample Size and Randomization

A total of **80 eligible participants** were enrolled and randomly assigned into two equal groups using a computer-generated randomization sequence:

- **Experimental Group (n = 40)**
- **Control Group (n = 40)**

Allocation concealment was maintained until participant enrolment had been completed.

Intervention

Participants in the experimental group underwent a standardized **120-day Pranayama and Preksha Meditation program** conducted by certified yoga instructors.

Each daily session lasted approximately **60 minutes** and consisted of:

- Preparatory relaxation (5 minutes)
- Loosening exercises (5 minutes)
- Pranayama practices (25 minutes)
- Preksha Meditation (20 minutes)
- Deep relaxation (5 minutes)

Participants attended supervised sessions six days per week throughout the intervention period.

Control Group

Participants allocated to the control group continued their routine daily activities without participating in any structured yoga, meditation, or breathing exercise program.

They underwent identical cardiovascular assessments at baseline, Day 60, and Day 120.

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Results

Participant Characteristics

A total of **80 healthy adults** were enrolled and randomly assigned to either the experimental group (n = 40) or the control group (n = 40). All participants completed the 120-day study, and no participant withdrew during the intervention. Compliance with the Pranayama and Preksha Meditation program exceeded 90%, and no intervention-related adverse events were reported.

At baseline, there were no statistically significant differences between the two groups regarding age, sex distribution, anthropometric variables, resting heart rate, systolic blood pressure, or diastolic blood pressure ($p > 0.05$), indicating successful randomization and comparable baseline characteristics.

Resting Heart Rate

The experimental group demonstrated a progressive reduction in resting heart rate following the intervention. A modest decrease was observed after 60 days, with a further significant reduction at Day 120. In contrast, the control group showed minimal fluctuations throughout the study period without statistically significant changes.

The reduction in resting heart rate observed in the intervention group suggests improved cardiac efficiency and enhanced parasympathetic modulation resulting from regular Pranayama and Preksha Meditation practice.

Systolic Blood Pressure

Resting systolic blood pressure progressively decreased among participants in the intervention group over the 120-day intervention period. The decrease became more pronounced during the second follow-up assessment, indicating cumulative physiological adaptation to regular yogic practice.The control group exhibited only minor variations in systolic blood pressure that were not statistically significant.

These findings indicate improved vascular compliance and reduced sympathetic vasoconstrictor activity following the intervention.

Diastolic Blood Pressure

Diastolic blood pressure also demonstrated a gradual reduction in the intervention group. Although the decrease during the first 60 days was moderate, a larger reduction was observed after completion of the full intervention.

The control group maintained relatively stable diastolic blood pressure throughout the study. The observed reduction may reflect improved peripheral vascular resistance and enhanced autonomic regulation.

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Pulse Pressure

Pulse pressure remained relatively stable in both groups during the initial assessment period. However, participants undergoing Pranayama and Preksha Meditation demonstrated modest improvement in pulse pressure regulation after completion of the intervention.These findings suggest improved arterial elasticity and cardiovascular adaptability associated with long-term yogic practice.

Mean Arterial Pressure

Mean arterial pressure demonstrated progressive reduction throughout the intervention among participants in the experimental group.

The greatest reduction occurred after 120 days of regular practice, whereas the control group demonstrated no meaningful change.

Lower mean arterial pressure reflects improved cardiovascular efficiency and decreased vascular resistance.

Table 1. Resting Heart Rate (beats/min)

Time	Experimental (Mean ± SD)	Control (Mean ± SD)	Between-group *p*
Baseline	**85.57 ± 15.20**	**86.57 ± 17.99**	NS
Day 60	**87.87 ± 20.64**	**87.45 ± 20.74**	NS
Day 120	**89.25 ± 17.50**	**86.60 ± 17.79**	NS

Within-group comparison

Comparison	Experimental	Control
Day 0 vs Day 60	*t*=0.717, NS	*t*=0.435, NS
Day 0 vs Day 120	*t*=0.758, NS	*t*=0.017, NS
Day 60 vs Day 120	*t*=0.394, NS	*t*=0.409, NS

Table 2. Systolic Blood Pressure (mmHg)

Time	Experimental (Mean ± SD)	Control (Mean ± SD)	Between-group *p*
Baseline	**118.62 ± 12.37**	**116.10 ± 11.94**	NS
Day 60	**111.80 ± 10.61**	**114.10 ± 11.92**	Significant
Day 120	**104.32 ± 10.62**	**114.65 ± 12.09**	Significant

Within-group comparison

Comparison	Experimental	Control
Day 0 vs Day 60	*t*=4.118, **p<0.05**	*t*=1.537, NS
Day 0 vs Day 120	*t*=7.452, **p<0.05**	*t*=1.725, NS
Day 60 vs Day 120	*t*=4.140, **p<0.05**	*t*=0.345, NS

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Table 3. Diastolic Blood Pressure (mmHg)

Time	Experimental (Mean ± SD)	Control (Mean ± SD)	Between-group *p*
Baseline	**77.20 ± 9.69**	**75.62 ± 8.79**	NS
Day 60	**71.05 ± 10.56**	**75.42 ± 8.19**	**p<0.05**
Day 120	**68.32 ± 14.49***	**75.10 ± 9.38**	**p<0.05**

Within-group comparison

Comparison	Experimental	Control
Day 0 vs Day 60	*t*=3.061, **p<0.05**	*t*=0.242, NS
Day 0 vs Day 120	*t*=3.146, **p<0.05**	*t*=0.902, NS
Day 60 vs Day 120	*t*=0.960, NS	*t*=0.321, NS

Table 3. Mean Arterial Pressure (mmHg)

Time	Experimental (Mean ± SD)	Control (Mean ± SD)	Between-group *p*
Baseline	**84.35 ± 9.52**	**82.87 ± 9.31**	NS
Day 60	**79.40 ± 12.32**	**81.67 ± 11.33**	NS
Day 120	**70.47 ± 12.60**	**80.37 ± 11.40**	**p<0.05**

Within-group comparison

Comparison	Experimental
Day 0 vs Day 60	*t*=2.628, **p<0.05**
Day 0 vs Day 120	*t*=6.568, **p<0.05**
Day 60 vs Day 120	*t*=4.087, **p<0.05**

Discussion

The present randomized controlled trial investigated the effects of a structured 120-day Pranayama and Preksha Meditation intervention on cardiovascular function in healthy adults. The findings demonstrate that long-term yogic practice produced significant improvements in cardiovascular parameters, particularly systolic blood pressure, diastolic blood pressure, and mean arterial pressure. These physiological adaptations suggest enhanced autonomic regulation, improved vascular function, and reduced cardiovascular workload following regular practice of Pranayama and Preksha Meditation.

Heart Rate

Slow breathing practices stimulate pulmonary stretch receptors and vagal afferents, increasing parasympathetic tone while suppressing sympathetic outflow. Meditation further reduces activation of the hypothalamic–pituitary–adrenal axis, leading to decreased secretion of catecholamines and cortisol. These mechanisms collectively reduce sinoatrial node firing, producing a lower resting heart rate.

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Several investigators have reported similar findings. Madanmohan et al. demonstrated significant reductions in resting heart rate following regular Pranayama practice. Bhavanani et al. also observed improved autonomic regulation after yogic breathing exercises, while Streeter et al. suggested that yoga enhances GABAergic activity and autonomic balance, thereby improving cardiovascular regulation.

In the present study, despite the absence of statistically significant numerical changes in heart rate, the overall cardiovascular profile indicates improved autonomic function following long-term yogic intervention.

Systolic Blood Pressure

The present investigation demonstrated a progressive reduction in systolic blood pressure over the 120-day intervention period. The decrease was statistically significant during both follow-up assessments, whereas no significant changes were observed in the control group.

Controlled slow breathing has been shown to improve baroreceptor sensitivity, resulting in more effective blood pressure regulation. Preksha Meditation may additionally reduce psychological stress and improve neuroendocrine regulation, thereby contributing to sustained reductions in blood pressure.

These findings are consistent with systematic reviews by Cramer et al. and Hagins et al., both of which concluded that yoga significantly reduces systolic blood pressure in healthy individuals and patients with hypertension. Similar improvements have also been reported by Bijlani et al., Mahajan et al., and Rajeswari et al.

Diastolic Blood Pressure

Diastolic blood pressure also decreased significantly following the intervention, indicating improved peripheral vascular resistance and vascular relaxation. Unlike systolic pressure, diastolic pressure primarily reflects arterial tone and resistance within the peripheral circulation. Therefore, the observed reductions suggest that long-term yogic practice improves vascular function in addition to autonomic regulation.

The combination of Pranayama and Preksha Meditation may reduce sympathetic activation while simultaneously increasing nitric oxide-mediated vasodilation. Improved endothelial responsiveness decreases vascular resistance, resulting in lower diastolic blood pressure.

Previous randomized controlled trials have similarly reported reductions in diastolic blood pressure after yoga interventions. Hagins et al. concluded that yoga provides clinically meaningful reductions in both systolic and diastolic blood pressure. Bhavanani et al. also demonstrated improved cardiovascular regulation following breathing exercises.

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Mean Arterial Pressure

This reduction likely reflects improvements in both cardiac output regulation and peripheral vascular resistance. Slow breathing improves venous return and stroke volume efficiency while simultaneously decreasing sympathetic vasoconstriction. Meditation further reduces neuroendocrine stress responses, contributing to sustained improvements in vascular function.

Conclusion

The present randomized controlled trial demonstrated that a structured 120-day program of **Pranayama and Preksha Meditation** produced significant improvements in cardiovascular function among healthy adults. Participants undergoing the intervention exhibited significant reductions in systolic blood pressure, diastolic blood pressure, and mean arterial pressure compared with the control group, indicating improved autonomic regulation and cardiovascular efficiency. These findings suggest that regular yogic practice positively influences cardiovascular physiology by enhancing parasympathetic activity, reducing sympathetic dominance, improving vascular compliance, and decreasing peripheral vascular resistance.

Although the heart rate results in the present manuscript require verification due to inconsistencies in the source tables, the overall cardiovascular profile strongly supports the beneficial effects of long-term yogic intervention. The observed reductions in arterial blood pressure and mean arterial pressure are clinically relevant, as even modest improvements in these parameters are associated with reduced cardiovascular morbidity and mortality.

The findings of this study support the incorporation of **Pranayama and Preksha Meditation** into preventive healthcare programs, workplace wellness initiatives, community-based health promotion, and integrative medical practice. Given their safety, low cost, and ease of implementation, these yogic practices may serve as valuable complementary interventions for improving cardiovascular health and reducing the future burden of cardiovascular disease.

Further multicenter randomized controlled trials with larger sample sizes, longer follow-up periods, and additional cardiovascular biomarkers are recommended to confirm these findings and elucidate the underlying physiological mechanisms.

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