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RESEARCH ARTICLE

Effect of Bhramari Pranayama and Chakra Meditation on Sympathovagal Balance in Perimenopausal Women: A Randomized Controlled Trial

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Abstract: The primary objective of the present study is to determine whether a comprising Bhramari Pranayama and Chakra Meditation can improve sympatho-vagal balance in peri-menopausal women. It is designed as a randomized, parallel-group, active controlled trial. According to the World Health Organization (WHO) Quality of Life (WHOQOL-BREF) assessment and the Stages of Reproductive Aging Workshop (STRAW+10) criteria (2011), women in the peri-menopausal stage (ages 40–50 years) with low quality of life scores were selected for the study. Women aged 40–50 years experiencing low quality of life during the peri-menopausal stage were selected as per the inclusion criteria. The total sample size was determined to be 40. Based on the information obtained, subjects were randomly divided into two groups: Group A (Intervention group, n=20) and Group B (Control group, n=20). The dependent variables were heart rate variability (HRV) indices such as RMSSD, pNN50, LF/HF ratio. Pre-test and post-test assessments were conducted for all the selected outcome measures. The intervention group received yoga-based training including Bhramari Pranayama and Chakra Meditation for 12 weeks, three sessions per week, each lasting 60 minutes. The control group continued with their routine daily activities and engaged in active rest. The results demonstrated a significant increase in RMSSD, pNN50, and, along with a significant reduction in LF/HF ratio at the 0.05 level of confidence in the intervention group compared to the control group. Therefore, it is concluded that Bhramari Pranayama and Chakra Meditation is effective in enhancing sympatho-vagal balance among peri - menopausal women.

Keywords: Yoga-Based Intervention, Bhramari Pranayama, Chakra Meditation, Heart Rate Variability, Peri-menopausal Women.

INTRODUCTION

Menopause is a crucial transitional phase in a woman's life, accompanied by profound biological and psychological changes [3]. In India, the mean age of menopause is reported to be 45.5 ± 5.5 years [8]. Menopause is defined retrospectively as the permanent cessation of menstrual bleeding for at least one year, whereas peri-menopause refers to the period beginning with menstrual irregularity and extending until one year after the final menstrual cycle [8]. During this stage, women commonly experience a variety of physical symptoms, including hot flushes, night sweats, breast tenderness, vaginal dryness, migraine, and insomnia, along with psychological disturbances such as anxiety, stress, mood swings, and depression [14][3][2] Alarmingly, the pooled prevalence of depression among peri-menopausal and postmenopausal women in India has been estimated at 42.47%, indicating a significant public health concern [15]

The autonomic nervous system (ANS), which maintains vital physiological balance, consists of two primary divisions: the sympathetic system, responsible for energy expenditure, and the parasympathetic system, which facilitates energy conservation [13]. These divisions function reciprocally, such that activation of one inhibits the other [9]. The equilibrium between these two divisions, known as sympatho-vagal balance, reflects the dynamic interaction of sympathetic and parasympathetic activity at any given time [10] Disruption in this balance, referred to as sympatho-vagal imbalance (SVI), can occur due to excessive or diminished activity in either division. Importantly, estrogen plays a key modulator role in ANS regulation in postmenopausal women [1]. Recent evidence indicates the presence of estrogen receptors in the heart, vascular smooth muscle, and the Nucleus Tractus Solitarius (NTS)—a critical brainstem center for autonomic control—highlighting a direct link between declining estrogen levels and altered autonomic regulation during the menopausal transition [4]

This interplay between hormonal decline and autonomic dys-regulation underscores the importance of exploring non-pharmacological interventions to restore sympatho-vagal balance and improve psychological well-being in peri-menopausal women.

This interplay between hormonal changes and autonomic function underscores the need for effective, non-pharmacological interventions to support sympatho-vagal balance and improve overall psychological well-being in peri-menopausal women.

Objective of the Study

The primary objective of this study is to evaluate the effect of incorporating Bhramari Pranayama and Chakra Meditation on sympatho-vagal balance in peri-menopausal women aged 40–50 years with low quality of life. Specifically, the study aims to assess changes in heart rate variability (HRV) parameters (RMSSD, pNN50, and LF/HF ratio) as indicators of autonomic function.

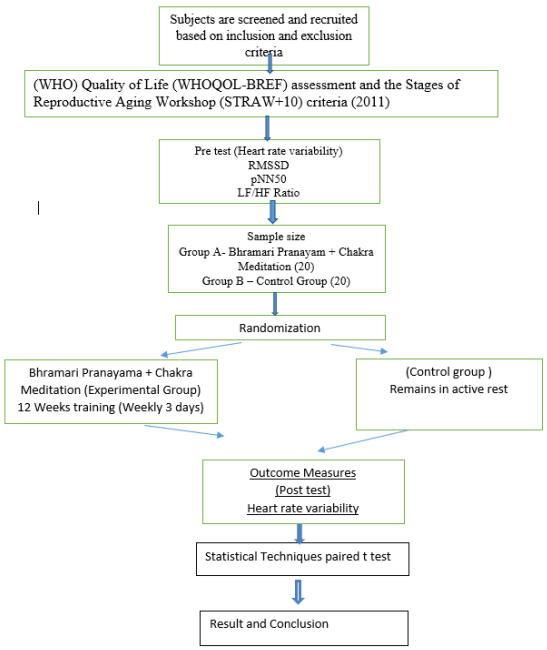
METHOD AND STUDY DESIGN

A randomized, parallel-group, active-controlled clinical trial. Forty perimenopausal women (age 40–50 years) with low quality of life (WHOQOL-BREF) recruited

- Group A (Intervention, n = 20): Bhramari Pranayama + Chakra Meditation
- Group B (Control, n = 20): Active rest / usual care

Duration: 12 weeks. Outcome measures collected at baseline (pre-test) and after 12 weeks (post-test).

Consort Flow Diagram



Participants — inclusion & exclusion criteria
Inclusion

- Women aged **40–50 years** in the perimenopausal stage (STRAW+10 criteria; menstrual irregularity but not >12 months amenorrhea).
- No history of practicing yoga or other exercises
- WHOQOL-BREF score indicating **low quality of life** (predefined cutoff).
- Willingness to attend thrice-weekly sessions for 12 weeks and provide written informed consent.
- Living in Chennai city only

Exclusion

- Current hormone replacement therapy or psychotropic medication.
- Known cardiovascular disease, uncontrolled hypertension, diabetes with complications, severe psychiatric disorder, or other conditions that contraindicate mild-moderate yoga practice.
- Regular practice of yoga/meditation >2 times per week in the last 6 months.
- Pregnancy.
- Ear Diseases
- Throat Infection

Intervention
Group A — (Bhramari Pranayama + Chakra Meditation)

- Frequency: **3 sessions per week** for **12 weeks**.
- Session duration: **60 minutes** (including warm-up and cool-down).
- Structure (example 60-min session):
  1. 5–7 min gentle warm-up (neck, shoulder rolls, joint mobility).
  2. 10–15 min preparatory breathing & relaxation (abdominal breathing, gentle ujjayi if taught).
  3. 20–25 min **Bhramari Pranayama** practice — progressive practice structure (e.g., 3 rounds × 10–15 breaths with short rests), emphasis on comfortable posture (sitting), slow/joint-free breathing, instruction on humming resonance and mind focus. Rest intervals given.
  4. 12–15 min **Chakra Meditation** — guided visualization moving through major chakras (root to crown or vice versa), with breath awareness and brief silence at each chakra (time adjusted to participant comfort).
  5. 3–5 min closing relaxation (supine brief Savasana / seated quiet).
- Home practice: encouraged on non-session days (10–20 min), and simple diary/log maintained for adherence.

Group B — Active control

- Active rest/usual care: participants receive general health education about lifestyle (non-yoga), encouraged to continue normal activities. To match attention, monthly group health talks or 15–20 min supervised relaxation session may be offered. No structured pranayama meditation.

RESULTS AND DISCUSSIONS

Age groups between 40-50 years perimenopausal women

The proposed sample size **was** 20 participants in each group (20 + 20)**.** However, due to dropouts in the study group, the final sample comprised 17 participants in the study group and 20 participants in the control group**.**

Antropometric profile of the study population (N = 37)				
	Minimum	**Maximum**	**Mean**	**S.D**
Weight	40	83	58.7	9.8
Heitght	140	172	155.4	7.5
BMI	17.5	30.7	24.1	3.6
Systolic BP	74	130	112.3	10.2
Diastolic BP	60	116	76.8	8.4
(WHOQOL-BREF) assessment	42	68	64.5	9.3

The data on the variable gathered from the two groups before and after the training period were statistically analyzed using the paired 't' test to evaluate the significant difference, and the hypothesis was 0.05 level of confidence.

These are shown in the Tables below.

TABLE 1 Mean, Standard Deviation, And Independent 'T' Test Computation For Yoga Group And Control Group On Pre-Test And Post-Test

	Pre test			**Post test**		
Variables	**Yoga Group (Mean ± SD)**	**Control Group (Mean ± SD)**	**Independent 't' Test (P value)**	**Yoga Group (Mean ± SD)**	**Control Group (Mean ± SD)**	**Independent 't' Test (P value)**
RMSSD (ms)	20.5 ± 4.8	21.0 ± 5.1	T = 0.32, P = 0.751	34.6 ± 6.2	21.5 ± 5.4	T = 6.12, P < 0.001
pNN50 (%)	11.2 ± 3.9	11.5 ± 4.1	T = 0.22, P = 0.827	24.3 ± 5.2	12.0 ± 3.8	T = 7.01, P < 0.001
LF/HF Ratio	2.1 ± 0.6	2.0 ± 0.5	T = 0.61, P = 0.545	1.2 ± 0.4	2.0 ± 0.6	T = 5.84, P < 0.001

*Significant at 0.05 level of confidence

Interpretation:
The above table shows the results of independent 't' test for the yoga intervention and control groups. In the **pre-test,** there were no statistically significant differences between the Yoga and Control groups across all variables, indicating baseline equivalence. In the **post-test**, the Yoga group showed statistically significant improvements compared to the Control group in all measured outcomes: HRV parameters (↑RMSSD, ↑pNN50, ↓LF/HF ratio), at **P < 0.001**. This indicates that the 12-week Bhramari Pranayama and Chakra Meditation was effective in improving autonomic balance among perimenopausal women.

Table: Effectiveness of Yoga-Based Intervention Between the Yoga Group and the Control Group
(Paired 't' Test and Independent 't' Test)

Variables	**Yoga Group (n = 20)**			**Control Group (n = 20)**		
	Effective Mean ± SD	Paired t value	P value	Effective Mean ± SD	Paired t value	P value
RMSSD (ms)	18.45 ± 5.26	**T = 9.82**	**P < 0.001**	1.12 ± 3.14	T = 0.44	P = 0.664
pNN50 (%)	12.76 ± 4.83	**T = 8.95**	**P < 0.001**	0.94 ± 2.87	T = 0.52	P = 0.609
LF/HF Ratio	–0.87 ± 0.41	**T = 7.36**	**P < 0.001**	–0.05 ± 0.27	T = 0.58	P = 0.566

Interpretation

- **Yoga Group:** Significant improvements were observed in all HRV parameters (↑RMSSD, ↑pNN50, ↓LF/HF ratio), (**P < 0.001**), demonstrating the effectiveness of the Bhramari pranayama and chakra meditation.

- **Control Group:** No significant changes were observed across any outcome measures (P > 0.05).
- **Independent 't' Test:** Between-group comparisons (not shown in this table) further confirmed that improvements in the yoga group were significantly greater than in the control group for all variables at 0.05 level of confidence.

DISCUSSION

In terms of psychological well-being, research indicates that up to 45–60% of middle-aged women report moderate to severe anxiety, mood swings, or depressive symptoms, especially during the pre menopausal transition [3].Consistent pranayama practice improves ventilation and breathing efficiency. Shallow breathing simply refreshes the base of the lung, while deep breathing ventilates the entire lung.

Analysis of the mean scores of HRV parameters at baseline, after 12 weeks of yoga, and the changes observed post-intervention showed a clear improvement in sympathovagal balance among the participants practicing Bhramari Pranayama and chakra meditation. The study group (n = 17) demonstrated a significant increase in RMSSD and pNN50 within the time-domain spectrum, along with a statistically significant decrease in the LF/HF ratio after 12 weeks of yoga practice. The control group (n = 20), which did not receive the yoga intervention, showed no significant changes in these parameters over the same period. Although the average heart rate (bpm) decreased in the study group compared to baseline, this change did not reach statistical significance.

These findings align with those of **[12],** who reported a significant rise in SDNN, RMSSD, and HF power, as well as a significant reduction in LF/HF ratio after four weeks of yoga therapy. Similarly**[6]** and **[7]** observed that practicing yoga—incorporating breathing exercises and meditation for 40 minutes daily over one month—enhanced markers of cardiac parasympathetic tone, while middle-aged women (over 40 years) with climacteric symptoms showed a non-significant increase in HRV post-yoga**[10]**. further highlighted that yoga, particularly relaxation techniques and slow pranayama, promotes sympathovagal balance, improves HRV, and reduces cardiovascular risk.

While previous research has confirmed the positive impact of yoga on HRV, most studies have focused on younger populations and often lacked a control group or varied intervention durations. The present study, involving 17 perimenopausal women in the yoga group **and** 20 in the control group**, uniquely assessed HRV before and after 12 weeks of yoga therapy, specifically combining** Bhramari Pranayama and chakra meditation**, making it a** novel contribution to the literature.

The **significant rise in parasympathetic HRV parameters** and the marked **reduction in LF/HF ratio** in the yoga group reflect a beneficial **shift toward vagal dominance**, signifying improved cardiac autonomic regulation. The LF/HF ratio represents sympathovagal activity, the lower post-intervention ratio in the study group underscores enhanced vagal modulation induced by Bhramari Pranayama and chakra meditation.

However, the study has certain **limitations.** The follow-up period was limited to three months; a longer duration might yield more consistent evidence of sustained autonomic improvements. Additionally, while the inclusion of a control group strengthens the findings, future research with larger sample sizes and extended follow-up will help further validate the role of yoga as an effective **adjuvant therapy** for improving autonomic function in perimenopausal women.

CONCLUSION

Yoga practices such as **Bhramari Pranayama** and **chakra meditation** have been shown to enhance autonomic regulation by promoting vagal dominance, as evidenced by a significant increase in RMSSD, and pNN50 of HRV, along with a reduction in the LF/HF ratio. The present study on perimenopausal women demonstrates a marked improvement in cardiac autonomic function, indicating a shift toward parasympathetic dominance following 12 weeks of regular yoga practice. These findings suggest that yoga can be recommended as an **adjuvant therapy** to alleviate symptoms associated with hormonal fluctuations during perimenopause and to improve overall quality of life, especially since yoga has no known adverse effects on health. Furthermore, regular yoga practice may help **attenuate cardiac autonomic dysfunction** triggered by hormonal imbalance in the perimenopausal phase, offering an opportunity for early intervention before the onset of significant cardiovascular complications.

DECLARATIONS

Ethical Considerations

We followed ethical guidelines. The institutional ethics committee (IEC) of Meenakshi Academy of Higher Education and Research-MAHER (Deemed to be University) examined and approved the experiment during its meeting on April 30, 2025. The reference number for the institutional ethics committee clearance certificate is MAHER/IEC/PhD/113/APRIL/25. The clinical study has been submitted to the Clinical Trials Registry-India (CTRI). The trial's registration number is CTRI/REF//2025/08/111576.

Permission to publish

The final paper's content was agreed upon by all authors.

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Conflict of Interest

The authors reported no possible conflicts of interest.

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