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# Treating the climacteric symptoms in Indian women with an integrated approach to yoga therapy: a randomized control study

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## Abstract

**Objective:** To study the effect of yoga on the climacteric symptoms, perceived stress, and personality in perimenopausal women.

**Method:** One hundred twenty participants (ages 40-55 y) were randomly divided into two study arms, ie, yoga and control. The yoga group practiced an integrated approach to yoga therapy comprising *surya namaskara* (sun salutation) with 12 postures, *pranayama* (breathing practices), and *avartan dhyan* (cyclic meditation), whereas the control group practiced a set of simple physical exercises under supervision of trained teachers for 8 weeks (1 h daily, 5 days per week). The assessments were made by Greene Climacteric Scale, Perceived Stress Scale, and Eysenck's Personality Inventory before and after the intervention.

**Results:** Of the three factors of the Greene Climacteric Scale, the Mann-Whitney test showed a significant difference between groups ( $P < 0.05$ ) in the vasomotor symptoms, a marginally significant difference ( $P = 0.06$ ) in psychological factors but not in the somatic component. Effect sizes were higher in the yoga group for all factors. There was a significantly greater degree of decrease in Perceived Stress Scale scores ( $P < 0.001$ , independent samples *t* test) in the yoga group compared with controls (between-group analysis) with a higher effect size in the yoga group (1.10) than the control (0.27). On the Eysenck's Personality Inventory, the decrease in neuroticism was greater ( $P < 0.05$ ) in the yoga group (effect size = 0.43) than the control group (effect size = 0.21) with no change in extroversion in either the yoga or control group.

**Conclusions:** Eight weeks of an integrated approach to yoga therapy decreases climacteric symptoms, perceived stress, and neuroticism in perimenopausal women better than physical exercise.

**Key Words:** Climacteric – Yoga – Cognitive abilities.

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Because the average life span of women in India has approached 62 years, the problems of menopause have attained a greater significance,<sup>1</sup> and the study of menopause is emerging as an issue.<sup>2</sup> The Indian subcontinent is a mix of many ethnic groups and cultures where the perception of menopause varies and symptoms are different from region to region. Although the most striking feature of menopause is the cessation of menstruation, other biological and psychosocial events occur and can be classified as stressors or facilitators.<sup>3</sup> A study in seven Southeast Asian countries (Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, and Taiwan), in which approximately 400 women in each country were questioned about a number

of climacteric complaints; the prevalence of hot flashes and sweating was lower than in Western countries, but was nevertheless not negligible.<sup>4</sup>

At menopause, some women present a clinical picture of not only the specificity of estrogen deficiency, such as hot flashes, but also a nonspecific psychological syndrome characterized largely by anxiety and depression.<sup>5</sup> A cohort of 16,065 women ages 40 to 55 years examined the association between psychological distress and natural menopause in a community sample of African American, white, Chinese, Hispanic, and Japanese women participating in a national women's health study. Rates of psychological distress were highest in early perimenopause (28.9%) and lowest in premenopause (20.9%) and postmenopause (22%). In a US sample of 170 menopausal women between the ages of 45 and 54, menopausal symptoms, seeking social support, and neuroticism accounted for 21% of the variance in rating menopause as stressful.<sup>6</sup> Perimenopausal depressed women are more likely to report both negative life events and diminished self-esteem.<sup>7</sup>

Hormone therapy (HT) holds a risk of breast cancer and a threefold risk of venous thromboembolism, inducing feelings of fear.<sup>8</sup> A randomized, controlled study of healthy postmenopausal women who were taking oral HT observed that

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stress coping did not change after estrogen therapy. The women in the target group were successfully treated for vasomotor symptoms but had significantly higher neuroticism score compared with the comparison group.<sup>9</sup> The stress coping is an individual propensity and not dependent on specific hormonal status during menopause. Because of the serious adverse effects of HT, there has been a gap in the management of menopausal symptoms, emphasizing the need to develop and explore the efficacy of alternative therapeutic avenues that have recently demonstrated promise in alleviating menopausal symptoms.<sup>10</sup>

Among nonpharmacological alternative therapies that have been studied, one study used relaxation response in 33 menopausal women who demonstrated significant decreases in hot flash intensity, tension/anxiety, and depression.<sup>11</sup> Yoga, developed thousands of years ago, is emerging as a form of mind-body medicine. An Indian study observed a remarkable decrease ( $P < 0.001$ ) in the anxiety scores within 10 days of an educational yoga program for lifestyle modification and stress management.<sup>12</sup> Women with emotional distress who participated in yoga training demonstrated pronounced and significant improvements in perceived stress, state and trait anxiety, well-being, vigor, fatigue, and depression.<sup>13</sup> A pilot trial that chose eight restorative yoga poses for 8 weekly 90-minute sessions found that the mean number of hot flashes per week decreased by 30.8% and mean hot flash score decreased by 34.2% and demonstrated the feasibility of teaching yoga to middle-aged women without previous yoga experience. The high rates of participant retention and satisfaction suggest that yoga is an acceptable intervention in the American population.<sup>14</sup> After a 10-week yoga program comprising breathing techniques, postures, and relaxation poses designed specifically for menopausal symptoms, significant pre-/posttreatment improvements were found for severity of questionnaire-rated total menopausal symptoms, hot-flash daily interference, and sleep efficiency, disturbances, and quality.<sup>15</sup> An earlier three-arm randomized, controlled study also showed yoga to be as effective as walking in reducing the vasomotor symptoms of menopause.<sup>16</sup>

There are no randomized, controlled studies on yoga or meditation in perimenopause in Indian women. The present study was designed to examine the efficacy of an integrated approach to yoga therapy (IAYT), a nonpharmacological therapy that offers techniques to promote positive health at the physical, mental, social, and spiritual levels in alleviating perimenopausal symptoms.

## METHODS

### Participants

A sample size of 108 was derived for an effect size of 0.52 (calculated from the pre/post mean and SD values of the vasomotor outcome variable from an earlier study),<sup>17</sup> with  $\alpha$  at 0.05 and power at 0.8. Because the power would be lower for between-group analysis, a larger sample size of 120 was planned for the study.

Of 201 women experiencing menopausal symptoms screened, 120 women (married or single) who satisfied the inclusion criteria of (1) age between 45 and 55 years irrespective of whether they were menstruating regularly (symptomatic women who had stopped menstruating more than 3 years ago were also included) and (2) a serum follicle-stimulating hormone (FSH) level of 15 mIU/mL or more on the sixth day of the menstrual cycle if the woman was menstruating regularly or at the time of recruitment, if the woman had stopped menstruating or had irregular cycles were selected for the study. Women who had undergone hysterectomy with retained ovaries were also included. Exclusion criteria were (1) having practiced yoga for 1 month or more; (2) no knowledge of English; (3) less than high school education; (4) taking HT; (5) any surgery in past 3 months; (6) gynecological problems such as endometriosis, fibroids, ovarian cysts, and prolapsed uterus; (7) hypertension ( $\beta$ -blockers or centrally acting antihypertensive drugs may affect vasomotor symptoms); (8) diabetes mellitus (vasculopathy or autonomic neuropathy may affect vasomotor symptoms); (9) hypo-/hyperthyroidism, which may affect the sympathetic responses of climacteric; and (10) taking psychiatric medication.

### Source of participants

The study was conducted at Swami Vivekananda Yoga Research Foundation (SVYASA), a yoga university, in Bangalore city. Participants were recruited from gynecological outpatient clinics in 14 different areas of Bangalore through posters, newspaper advertisements, and circulation of pamphlets as well as through word of mouth. Classes were conducted at 14 nodal centers of SVYASA in different parts of the city.

Formal approval was obtained by the institutional review board and ethics committee of SVYASA. Signed informed consent was provided by each participant before recruitment after addressing any questions about the design of the study.

### Design

This was a prospective, randomized, controlled trial in which 120 participants were randomly divided into two study arms: one arm practiced an IAYT and the other arm practiced a set of physical exercises. The women who satisfied the inclusion criteria were registered in different nodal centers, and roll numbers were assigned that were randomly divided into two groups using a computer-generated random number table ([www.randomizer.org](http://www.randomizer.org)) prepared for the specific number of participants available in the center. Participants were assessed for the menopausal and psychological symptoms before and after the eighth week of intervention. Both yoga and control groups were given their respective set of exercises, which were done for 1 hour per day, 5 days per week for 8 weeks, by trained instructors for both yoga and nonyoga groups.

### Blinding

Because this was an interventional study, it could not be a double-blind study, but attempts were made to blind and

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mask wherever feasible to reduce the bias. The statistician who did the randomization of the serial numbers of participants and the final analysis was blind to the source of the data. The response sheets for the Greene Climacteric Scale (GCS), Eysenck's Personality Inventory (EPI), and Perceived Stress Scale (PSS) were coded and kept away for final analysis and were decoded only after complete analysis. The questionnaires were administered by a psychologist (who was not involved in interacting with the participants) to the whole group before randomization. Care was taken to arrange the timing and venue of the classes for the two groups suitably to avoid interaction and exchange of information and techniques between participants of the two groups.

**Assessments**

**Biochemical**

Serum FSH was used for initial screening of the women to satisfy one of the inclusion criteria. Blood samples for serum FSH levels were collected in Anand Diagnostic Laboratory, Bangalore. Estimation of FSH was carried out by the electrochemiluminescence method using Roche Elecsys 2010 FSH kit. Per the standardization, the normal range for the FSH values during the follicular phase for regularly menstruating Indian women is 3.5 to 12.5 mIU/mL (Anand Laboratory FSH reference value). For the present study, a value greater than 15 mIU/mL was considered for the inclusion criterion.<sup>18</sup>

**GCS**

The GCS is a menopause rating scale consisting of 21 items pertaining to the psychological, somatic, and vasomotor symptoms of menopause with a severity scale from 0 to 3 (0 = not at all, 1 = a little bit, 2 = quite a bit, 3 = extremely). The participants were instructed to indicate the most appropriate severity rating according to the present state of their health.<sup>19</sup> A study was conducted with Indian menopausal women (N = 518) in which the GCS was administered. The scores for psychological, somatic, and vasomotor symptoms were calculated using the factor analysis done on a larger Indian perimenopausal population.<sup>20</sup> That analysis showed a slight difference from the factor structure derived by Greene in 1976 for a European population.<sup>21</sup> The test-retest reliability of 50 menopausal women over a 2-week period had yielded the following reliability coefficients: psychological scale = 0.87, somatic (physical) scale = 0.84, and vasomotor scale = 0.83, which were statistically highly significant.<sup>22</sup> For content validity, only symptoms confirmed by other factorial studies as having a statistically significant factor loading were included in the final scale.<sup>23</sup>

**PSS**

The PSS is a widely used psychological instrument for perception of stress. Items were designed to determine how unpredictable, uncontrollable, and overloaded respondents find their lives. The scale also includes a number of direct queries about current levels of experienced stress. It has 10 questions about the feelings and thoughts during the past

month.<sup>24</sup> Validity and reliability of the test has been documented in many studies.<sup>25</sup>

**EPI**

The EPI measures two major dimensions of personality: extroversion and neuroticism. It is a 57-item dichotomous questionnaire rating the two psychological states: neuroticism (24 items) and extroversion (24 items) with nine questions for lying scores. The scoring is accomplished by aligning the scoring keys furnished, with the manual counting one for each underlined answer uncovered by the holes in the keys. A lying score of 5 is set as the cutoff point where inventory answers cease to be accepted. The test-retest reliability of the EPI runs between 0.84 and 0.94.<sup>26</sup>

**Intervention**

**Yoga intervention**

The yoga module used for the IAYT experimental intervention for perimenopausal women was developed specifically for the purpose culled from original scriptures (*Patanjali yoga sutras* and *Mandukaya karika*) that highlight the concepts of a holistic approach to health management at physical, mental, emotional, and intellectual levels with techniques to improve mental equilibrium. All these practices are aimed at one common goal, ie, to “develop mastery over modifications of the mind” (*chitta vritti nirodhah—Sage Patanjali*) through “slowing down the rate of flow of thoughts in the mind” (*manah prashamana upayah yogah—Sage Vasishtha*). Table 1 gives the list of practices: TIAQ4

1. Sun salutation includes a flow of 12 postures combined with breathing and chanting.<sup>27</sup>
2. Yogic breathing practices combined with simple body movements to achieve a slow, rhythmic breathing pattern, is the safest way to get mastery over the mind.<sup>28</sup> The principles involved in the technique of breathing were slow down the rate of breathing while synchronizing the body movements with breathing, ensure that exhalation was longer than inhalation, and practice with

**TABLE 1.** Practices used for the two intervention groups

| No. | Experimental group   | Control group  |
|-----|--|--|
| 1   | Lectures on IAYT, diet, emotion culture, concepts and management of stress according to yogic (15 min)   | Lectures on importance of exercise, role of diet in menopause, stress, stress physiology (15 min)  |
| 2   | Breathing exercises (10 min)<br><i>Hasta āyāma śvasanam</i> (hands in and out breathing)<br><i>Hasta vistāra śvasanam</i> (hands stretch breathing)<br><i>Gulpha vistāra śvasanam</i> (ankle stretch breathing)<br><i>Vyāghra śvasanam</i> (tiger breathing)<br><i>Setu bandha śvasanam</i> (bridge posture breathing) | Loosening practices (10 min):<br>Twisting<br><br>Forward and backward bending<br><br>Side bending<br><br>Spinal twist<br><br>Toe walking |
| 3   | <i>Suryanamaskara</i> (sun salutation) (10 min)  | Brisk walk (10 min)  |
| 4   | <i>Avartan dhyanam</i> (cyclic meditation) (25 min)  | Supine rest (25 min)   |

IAYT, integrated approach to yoga therapy.

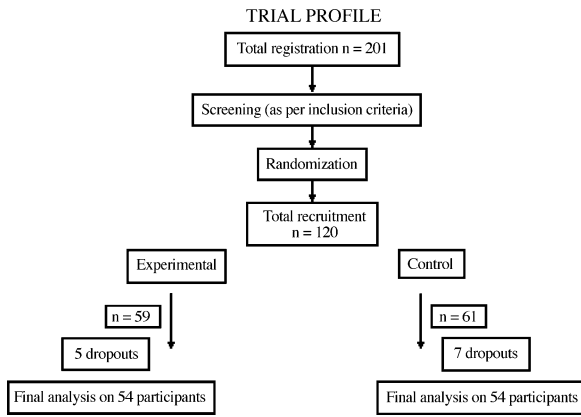


FIG. 1.

trainers for 1 hour daily 5 days per week for 8 weeks. They also had lectures and individual counseling on conventional modern medical concepts about a healthy lifestyle including diet, exercise, and physiology of menopause and stress management techniques.

**Data analysis**

The answer sheets of the questionnaires were scored per the instructions in the manual by a psychologist and were analyzed by the statistician using SPSS version 10.0. The Kolmogorov-Smirnov test of normality was used. To compare the pre/post values, nonparametric tests (Mann-Whitney for between yoga and control groups and Wilcoxon for within-group analysis) were used for GCS as the data were not normally distributed and parametric tests (independent samples *t* test and paired samples *t*) were used for EPI and PSS, which were normally distributed. In view of the small number of dropouts, intent-to-treat analysis was not planned.

The baseline values for all the variables in both groups were compared using an independent samples *t* test. Effect sizes were calculated to measure the magnitude of change after 8 weeks within and between the two groups.<sup>31</sup> Based on the results of factor analysis of the GCS in the south Indian population,<sup>20</sup> the first question of the GCS (“Is the heart beating quickly or strongly?”) was not taken into account as it did not contribute to any of the three factors (with nil factor loading). Correlations between the three factors with PSS and EPI were done by using Spearman’s  $\rho$  test.

**RESULTS**

Figure 1 describes the trial profile. Of 120 participants, there were total 12 dropouts, 5 in the yoga group and 7 in the control group due to inability to come to the venue regularly (attendance >75% considered regular) because of (1) husband’s ill health, (2) transfer to another city, and (3) unexpected events in the family. The analysis was done for a total of 108 participants (54 in each group). The trial profile shows that there were only 12 dropouts from the initial group of 120 participants.

full awareness of the touch of the flow of air through the nostrils down the air passages.

3. Cyclic meditation is considered to be a part of yoga that works directly at the mind level (*Antaranga yoga*), which is a valuable tool to reach a state of alertful rest (calming down or silencing the internal dialogue). Cyclic meditation is a 35-minute practice that includes a combination of activating and pacifying practices to reach deeper quietitude and equilibrium than meditating in a single posture.<sup>29</sup>
4. The women were given lectures on the physiology of menopause and a healthy lifestyle including diet, exercise, and yogic stress management techniques. They were also given yogic concepts to achieve a notional correction to help each woman (1) recognize her ability to tap her inner energy, which is made of immense bliss that could keep up her youthful feeling and allay fears, (2) restore her built-in freedom to change her responses to situations, and (3) learn to touch the bed of silence, which is the source of all creativity that is essential for promotion of any psychological function.<sup>30</sup>

**Control intervention**

The control group practiced a set of exercises comprising easy (nonsweating) body movements supervised by physical

TABLE 2. Demographic data

| S no. | Variables                  | Yoga group                  | Control group               |
|-------|----------------------------|-----------------------------|-----------------------------|
| 1     | Age, y (mean ± SD)         | 49 ± 3.60                   | 48 ± 4.00                   |
|       | No. of women aged 40-45 y  | 13                          | 14                          |
|       | No. of women aged 46-50 y  | 22                          | 23                          |
|       | No. of women aged 51-55 y  | 19                          | 17                          |
| 2     | W/H                        | 14/40                       | 9/45                        |
| 3     | BMI (mean ± SD)            | 28 ± 3.4                    | 29 ± 4                      |
| 4     | V/NV                       | 43/11                       | 45/9                        |
| 5     | Premenopausal              | No. FSH, mIU/mL (mean ± SD) | No. FSH, mIU/mL (mean ± SD) |
|       |                            | 14 43.88 ± 21.64            | 16 37.94 ± 17.52            |
|       | Irregular menstrual cycles | 17 47.16 ± 23.45            | 20 38.72 ± 14.94            |
|       | Menopause                  | 9 83.65 ± 43.59             | 7 56.90 ± 20.77             |
|       | Postmenopausal             | 14 59.50 ± 18.67            | 11 66.81 ± 21.14            |
|       | FSH, mIU/mL (mean ± SD)    | 56 ± 29.90                  | 47 ± 21.5                   |

There is no significant difference between groups in all the variables at baseline. W/H, working/housewives; BMI, body mass index; V/NV, vegetarian/nonvegetarian; FSH, follicle-stimulating hormone; Premenopausal, having regular menstruation; Menopause, menopause reached between 1 and 3 years ago; Postmenopausal, menopause reached more than 3 years ago.

TABLE 3. Greene Climacteric Scale results

| Factor | Yoga group    |                | Control group |                | <i>P</i> <sup>a</sup> |      | Effect size pre/post |      | <i>P</i> <sup>b</sup> |
|--------|---------------|----------------|---------------|----------------|-----------------------|------|----------------------|------|-----------------------|
|        | Mean ± SD pre | Mean ± SD post | Mean ± SD pre | Mean ± SD post | Y                     | C    | Y                    | C    | Y-C                   |
| PSY    | 6.18 ± 3.48   | 3.65 ± 2.76    | 5.42 ± 3.26   | 4.74 ± 3.04    | <0.001                | 0.01 | 0.83                 | 0.26 | 0.06                  |
| SOM    | 3.45 ± 2.44   | 2.16 ± 1.74    | 3.01 ± 1.90   | 2.16 ± 2.04    | <0.001                | 0.22 | 0.74                 | 0.19 | 0.19                  |
| VAS    | 2.31 ± 2.04   | 1.47 ± 1.30    | 2.16 ± 1.50   | 1.95 ± 1.30    | <0.001                | 0.24 | 0.66                 | 0.18 | 0.03                  |

PSY, psychological; SOM, somatic; VAS, vasomotor symptoms; Y, yoga group; C, control group.

<sup>a</sup>Wilcoxon test.

<sup>b</sup>Mann-Whitney test (only post results presented) calculated using SPSS version 10.0.

T2 Table 2 shows the demographic data. Maximum participation was from age group 46 to 50 years. Of the total participants, 87.76% were housewives, and those who worked were either high school teachers or bank officials.

**Baseline matching**

The baseline values were not significantly different between the yoga and control groups (*P* > 0.01) for all the variables including age, serum FSH, body mass index, psychological, somatic, vasomotor, perceived stress, and extroversion except neuroticism (higher scores in the yoga group).

**Comparisons with normative data**

The scores in this study for psychological (6.18 ± 3.48), somatic (6.16 ± 4.25), and vasomotor (4.41 ± 1.79) were much lower compared with those for the Scottish women (N = 50) with 12.33 ± 6.15, 3.45 ± 2.44, and 2.31 ± 2.04 for the three factors, respectively.<sup>22</sup> The values for extroversion and neuroticism in our population were also found to be much lower (10.77 ± 3.40 and 10.51 ± 4.59, respectively) than the normal scores (26.08 ± 8.55 and 17.37 ± 10.10, respectively) in American women. The score for PSS<sup>24</sup> is higher in the present study group (17.52 ± 6.38) than the normative values (12.60 ± 6.10) for American housewives.

**GCS**

There was a significant difference (*P* < 0.05) between groups in the vasomotor factor, a marginally significant difference (*P* = 0.06) in psychological factor, and no change in the somatic component (Table 3). Within-group analysis showed significant improvement in all three factors in the yoga group (*P* < 0.001) and for only the psychological factor (*P* < 0.05) in the control group. Effect sizes were higher in the yoga group for all factors.

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**PSS**

There was a significantly greater decrease in the yoga group compared with controls (between-group analysis) in PSS scores (*P* < 0.001) (Table 4). The magnitude of stress reduction was greater in the yoga group (effect size = 1.10) than in the control group (effect size = 0.27).

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**EPI**

There was a greater magnitude of change in neuroticism in the yoga group (effect size = 0.43) than in the control group (effect size = 0.21), with significant differences between groups (*P* < 0.05) (Table 5). Within-group analysis showed a

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highly significant decrease (*P* < 0.001) in the yoga group and no change in the control group. There was no significant change in extroversion in either group.

**Correlations**

There was a positive correlation between FSH and age and a negative correlation between FSH and extroversion on the EPI; anxiety and depression on the GCS were positively correlated with PSS and neuroticism on the EPI; somatic symptoms on the GCS positively correlated with PSS scores, neuroticism, FSH, and age; and vasomotor symptoms significantly correlated with PSS scores and neuroticism (Table 6).

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**DISCUSSION**

In this single-blind, prospective, randomized, two-armed study on 108 perimenopausal women, climacteric symptoms, perceived stress, and personality were assessed before and after 8 weeks of intervention. On the GCS, there was a significant difference between groups in the vasomotor factor, a marginally significant difference in the psychological factor, and no change in the somatic component. There was a significantly greater decrease in stress levels in the yoga group compared with the control group on the PSS. On the EPI, there was a greater change in neuroticism in the yoga group than in the control group. There were positive correlations between age and FSH and also between GCS, PSS, and neuroticism scores.

**Comparison of baseline with normative values**

The baseline values in this study on all variables were lower than the normative values provided in the manual,<sup>20,24,26</sup> except on the PSS. The most prominent difference was in the psychological and somatic symptoms on the GCS and the extroversion score on the EPI.<sup>22,26</sup> The differences in the scores could be explained by sociocultural differences between the two countries (United States and India). The evidence from different surveys to date indicates that

TABLE 4. Perceived Stress Scale results

| Group | Mean ± SD pre | Mean ± SD post | <i>P</i> <sup>a</sup> | Effect size pre/post | <i>P</i> <sup>b</sup> | Effect size Y-C |
|-------|---------------|----------------|-----------------------|----------------------|-----------------------|-----------------|
| Y     | 17.74 ± 6.15  | 11.74 ± 6.15   | <0.001                | 1.10                 | <0.001                | 0.66            |
| C     | 17.3 ± 6.61   | 15.63 ± 5.61   | 0.003                 | 0.27                 |                       |                 |

Y, yoga; C, control.

<sup>a</sup>Paired samples *t* test.

<sup>b</sup>Independent samples *t* test.

**TABLE 5.** Eysenck's Personality Inventory results

| Variable     | Mean ± SD pre | Mean ± SD post | P <sup>a</sup> | Effect size pre/post | P <sup>b</sup> | Effect size Y-C |
|--------------|---------------|----------------|----------------|----------------------|----------------|-----------------|
| Extroversion | 11.30 ± 3.88  | 11.31 ± 2.94   | 0.965          | 0.00                 | 0.006          | 0.54            |
| Y            |               |                |                |                      |                |                 |
| C            | 10.24 ± 2.92  | 9.83 ± 2.49    | 0.315          | 0.15                 |                |                 |
| Neuroticism  | 9.78 ± 4.36   | 7.91 ± 4.28    | <0.001         | 0.43                 | 0.009          | 0.51            |
| Y            |               |                |                |                      |                |                 |
| C            | 11.24 ± 4.82  | 10.24 ± 4.83   | 0.085          | 0.21                 |                |                 |

Y, yoga group; C, control group.

<sup>a</sup>Paired samples *t* test.

<sup>b</sup>Independent samples *t* test.

cultural differences in vasomotor symptom perception and reporting reflect both the underlying biological differences and an important sociocultural factor of the attitude toward menopause.<sup>32</sup>

**Comparison with other studies on physical exercise and perimenopausal symptoms**

The control group in the present study who practiced physical exercises for 8 weeks demonstrated decreased perception of stress and the psychological symptoms. Physical activities of different types have been found to be beneficial in climacteric women. In a 4-month randomized, controlled exercise trial with three arms, ie, walking, yoga, and control, it was observed that both walking and yoga were equally effective in enhancing a positive affect and menopause-related quality of life and decreasing a negative affect.<sup>16</sup> In another study of 50 pre- and postmenopausal women, the results of a 12-week exercise program provided only partial support for the role of aerobic exercise in reducing stress responses,<sup>33</sup> although both groups achieved comparable improvements in aerobic fitness.

**Comparison with other studies on yoga**

There are three published studies on yoga and perimenopausal symptoms. Of these, two were pilot studies that showed the beneficial effect and the other was the three-armed study that showed no significant difference between walking and yoga. The present study has clearly demonstrated through a randomized, controlled trial the superiority of yoga over physical activity in managing all three climacteric symptoms, stress, and neuroticism. The difference could be in the duration and frequency of administration and the type of the practices in different studies. This was also

observed by Waelde et al,<sup>34</sup> who concluded that the duration and frequency of the practice of yoga seems to be important because the average number of minutes of weekly yoga/meditation practice had a positive association with improvement in depression in their study of a six-session yoga/meditation program designed to help caregivers of dementia patients cope with stress. To date, we have many studies that provide evidence of the role of yoga in reducing anxiety and depression in the normal adult and geriatric populations as well. In a waitlist control design, the practice of Iyengar yoga showed significant decreases in self-reported symptoms of depression and trait anxiety in 28 young adults.<sup>35</sup> Another three-armed study in which IAYT was introduced to 69 elderly institutionalized individuals showed a significant decrease in their scores for depression in the yoga group at both 3 and 6 months.<sup>36</sup>

**Mechanism of action**

Sympathetic arousal resulting in increased catecholamines and cortisol levels mediated through the hypothalamic-pituitary-adrenal axis has been recognized to be the mechanism of increased stress and anxiety and the vasomotor and perimenopausal syndrome. Hence, the documented evidence of a decrease in these neurohumors and electrophysiological changes of sympathetic arousal after yoga practice had been proposed as its mode of action.<sup>37,38</sup>

**Mechanism, stress, yoga, biochemistry (cortisol and γ-aminobutyric acid [GABA])**

In a study that compared 20 stressed and 20 nonstressed, nonsmoking premenopausal women between the ages of 42 and 52 years, the stressed women had elevated evening salivary cortisol levels, indicating sympathetic arousal.<sup>39</sup>

There are randomized, controlled studies that have shown a significant decrease in stress levels after practicing yoga in participants with mild to moderate levels of stress<sup>40</sup> and also a trend for higher morning cortisol levels after 5 weeks of 1-hour weekly Iyengar yoga classes.<sup>35</sup> Robert McComb et al<sup>41</sup> in their study on resting levels of stress hormones, physical functioning, and submaximal exercise responses in women with heart disease undergoing an 8-week mindfulness-based stress-reduction program brought out the fact that just a once-weekly program of stress reduction is quite ineffective and fails to change stress hormone levels. An interesting study by Streeter et al<sup>42</sup> suggests that the practice of yoga may reduce the depressive symptoms of perimenopause by increasing

**TABLE 6.** Correlation matrix

| Variable | PSYCH             | SOM               | VAS               | PSS               | EXT               | NEU               | FSH               | Age               |
|----------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| PSYCH    | 1.00 <sup>b</sup> | 0.56 <sup>b</sup> | 0.40 <sup>b</sup> | 0.56 <sup>b</sup> | NS                | 0.61 <sup>b</sup> | NS                | NS                |
| SOM      |                   | 1.00 <sup>b</sup> | 0.44 <sup>b</sup> | 0.41 <sup>b</sup> | NS                | 0.43 <sup>b</sup> | NS                | 0.21 <sup>a</sup> |
| VAS      |                   |                   | 1.00 <sup>b</sup> | 0.27 <sup>a</sup> | NS                | 0.44 <sup>b</sup> | 0.25 <sup>a</sup> | 0.34 <sup>b</sup> |
| PSS      |                   |                   |                   | 1.00 <sup>b</sup> | NS                | 0.48 <sup>b</sup> | 0.18 <sup>a</sup> | NS                |
| EXT      |                   |                   |                   |                   | 1.00 <sup>b</sup> | NS                | 0.22              | NS                |
| NEU      |                   |                   |                   |                   |                   | 1.00 <sup>b</sup> | 0.20 <sup>a</sup> | NS                |
| FSH      |                   |                   |                   |                   |                   |                   | 1.00              | 0.19 <sup>a</sup> |
| Age      |                   |                   |                   |                   |                   |                   |                   | 1.00 <sup>b</sup> |

PSYCH, psychological; SOM, somatic; VAS, vasomotor symptoms; PSS, Perceived Stress Scale; EXT, extroversion; NEU, neuroticism; FSH, follicle-stimulating hormone; NS, not significant correlation.

<sup>a</sup>P < 0.05.

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GABA levels in the brain. This study examined the GABA levels by measuring the GABA-to-creatinine ratio in the brain using magnetic resonance spectroscopy in normal adult yoga and nonyoga practitioners and showed a 27% increase in GABA levels in the yoga group after a 60-minute yoga session with no change after a reading session in comparison with a nonyoga practitioner group.

#### **Yoga and electrophysiology for sympathetic tone**

Reduced sympathetic tone through yogic relaxation techniques has also been documented. In a control study on guided yogic relaxation, significant decreases in heart rate, skin conductance levels, and finger plethysmogram have been reported. In addition, the spectral analysis of heart rate variability showed a decrease in low-frequency (sympathetic tone indicator) and an increase in high-frequency (parasympathetic tone indicator) bands, indicating decreased physiological arousal.<sup>43</sup> Another study of seven experienced meditators studied in two types of sessions, ie, meditation (with a period of mental chanting of "OM") and control (with a period of nontargeted thinking), there was a significant decrease in heart rate and an increase in the cutaneous peripheral vascular resistance during meditation, which is a sign of increased mental alertness, even while being physiologically relaxed.<sup>44</sup>

#### **CM and rest**

A specific type of meditation called *avartan dhyanam* (CM) was incorporated as the main practice in the present study based on our earlier studies in which it is shown that CM brings about a deep state of physiological rest. Two days of a stress reduction program using CM in 26 executives with occupational stress showed a significant decrease in the power of the low-frequency component of the heart rate variability spectrum and low frequency-to-high frequency ratio and breath rate.<sup>45</sup> The oxygen consumption is considered a general index of the metabolic rate during physiological activities.<sup>46</sup> A significantly greater resting metabolic rate was found in a high trait anxious group than in a low trait anxious group,<sup>47</sup> suggesting that a higher rate of oxygen consumption may be associated with higher anxiety.<sup>48</sup> A reduction in oxygen consumption has been reported after meditation practices and relaxation response.<sup>43</sup> A rarely quoted traditional yoga scripture (*Mandukya karika*) points to an interesting intrinsic mental phenomenon that, in a meditative technique that involves a series of alternating activity (physical movements or mental chanting) and non-activity (relaxation or stoppage of internal dialogue) with awareness, the degree of rest that follows will be deeper than the physiological rest achieved during only restful meditation in one posture and hence can facilitate stress release at deeper levels. During CM, the extremely slow, conscious movements of the body provide a high sense of sensitivity to grasp the subtle changes happening inside the body, which may go unnoticed in a simple meditative state.<sup>28</sup> The practice of CM decreased oxygen consumption to 32% compared with the preceding period as well as with a reduction of 10.1% with a period of supine rest of equal duration.<sup>48</sup>

Despite the emergence of a range of nonhormonal treatments for menopausal symptoms, a need still exists for safe and effective therapeutic options that directly target the underlying thermoregulatory mechanisms for women who want treatment but prefer to avoid hormone therapy or for whom hormone therapy is contraindicated.<sup>49</sup> Thus, this study has shown the efficacy of integrated yoga in helping perimenopausal women improve their inner mastery, which could lead to better coping capacities, gracefully accept the change in their reproductive state, overcome stressors of aging, combat anxiety and depression, and thereby improve their personality to enjoy the freedom from monthly menstruation and divert their energies toward spiritual growth.

#### **Strength of this study**

This is the first randomized, controlled trial on yoga practice in Indian women of climacteric age. An objective measure, serum FSH level, was used as the inclusion criterion rather than only the subjective symptoms of menopausal rating scales. The types of practices for the yoga and control interventions were matched, and the practices were supervised by trained instructors for the entire period of the study.

#### **Limitations**

This randomized, controlled trial included a highly selective group of women, excluding those with associated illnesses such as diabetes and hypertension, which are common diseases of this age, because this would interfere with the uniformity of the intervention and the resultant conclusions. This may raise the question of generalizability of the application of the conclusions of this study to practice. Although earlier independent studies have shown the benefits of yoga in diabetes and hypertension,<sup>50</sup> it will be interesting to design studies that would recruit perimenopausal women with these common problems in future studies.

It would have been interesting to see the effect of the practice of IAYT if we had assessed FSH and estradiol levels before and after the intervention.

Because the significant benefits found in the control group on the psychological factor of the GCS and PSS would lead to bias toward the null hypothesis in conclusions on the effects of yoga, inclusion of a third group who do not do any practice in the design of the study would shed light on the true treatment effects.

#### **Suggestions for future work**

Inclusion of vasomotor symptom diaries as another variable could provide more detailed information about the efficacy of the intervention. Functional studies to look at the neurohormonal changes in the brain and autonomic functions during mental stress challenge before and after IAYT in perimenopausal women would shed light on the mechanism. This study has shown the benefits in Indian women. It will be useful to conduct similar studies in other countries where yoga may not be available as a traditional practice.

**Applications of the study**

Because yoga is popular as a complementary and alternative therapy with more than 15 million persons (more women) practicing yoga in the United States<sup>51</sup> and awareness among general practitioners,<sup>52</sup> this study can add to the scientific evidence so that gynecologists can recommend it to their patients instead of prescribing hormone therapy. Yoga, which is a self-corrective technique when popularized as a treatment modality, not only can prevent and treat the perimenopausal syndrome but also can help in preventing many of the stress-related problems of the modern lifestyle that these women are prone to after menopause. The philosophy and practices of yoga provide a good field of study for internal experimentation during the empty nest, postretirement phase of a woman’s life and help her to grow in her personality to lead a healthy and happy life.

**CONCLUSIONS**

This single-blind, prospective, randomized, controlled trial has shown that yoga decreases climacteric symptoms, perceived stress, and neuroticism in perimenopausal women better than physical exercise in 8 weeks. Thus, an IAYT could be one of the preferred nonhormonal, lifestyle-modifying regimens for perimenopausal women.

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