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Yoga decreases insomnia in postmenopausal women: a randomized clinical trial

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Abstract

Objective: The practice of yoga has been proven to have positive effects on reducing insomnia. Studies have also shown its effects on reducing climacteric symptoms. To date, however, no studies that evaluate the effects of yoga on postmenopausal women with a diagnosis of insomnia in a randomized clinical trial have been conducted. The aim of this study was to evaluate the effect of yoga practice on the physical and mental health and climacteric symptoms of postmenopausal women with a diagnosis of insomnia.

Methods: Postmenopausal women not undergoing hormone therapy, who were 50 to 65 years old, who had an apnea-hypopnea index less than 15, and who had a diagnosis of insomnia were randomly assigned to one of three groups, as follows: control, passive stretching, and yoga. Questionnaires were administered before and 4 months after the intervention to evaluate quality of life, anxiety and depression symptoms, climacteric symptoms, insomnia severity, daytime sleepiness, and stress. The volunteers also underwent polysomnography. The study lasted 4 months.

Results: There were 44 volunteers at the end of the study. When compared with the control group, the yoga group had significantly lower posttreatment scores for climacteric symptoms and insomnia severity and higher scores for quality of life and resistance phase of stress. The reduction in insomnia severity in the yoga group was significantly higher than that in the control and passive-stretching groups.

Conclusions: This study showed that a specific sequence of yoga might be effective in reducing insomnia and menopausal symptoms as well as improving quality of life in postmenopausal women with insomnia.

Key Words: Yoga – Postmenopause – Insomnia – Sleep disorders.

Climacterium is the phase in a woman's life that corresponds to the gradual transition from a reproductive to a nonreproductive stage. It begins around the age of 40 years, when the first endocrine alterations are detected. These alterations signify not only the exhaustion of ovary follicles but also the desynchronization of the neural signals in the hypothalamus and central nervous system. Menopause takes place within the climacteric phase, at around the age of 50 years, and is characterized by at least 12 months of amenorrhea.[1,2]

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The most prevalent symptoms of women entering menopause are vasomotor ones, which account for 70% to 80% of symptoms.[3,4] These vasomotor symptoms are considered at least partially responsible for sleep disorders after menopause.[5,6] Many women present with sleep disorders after menopause.[7] An epidemiological study conducted in São Paulo found that 81.6% of the interviewees had sleep complaints, and 52.1% of the respondents complained of insomnia.[8] Sleep problems tend to increase with age[9] and are more frequent in women during the menopausal transition.[10] A study that used both subjective (questionnaires) and objective (polysomnography) evaluations showed that 61% of postmenopausal women had subjective sleep complaints. The objective evaluation, however, revealed that 83% of women had sleep alterations.[7]

Hormone therapy (HT), that is, the exogenous replacement of the hormones produced by the ovaries, can be used to relieve climacteric symptoms. However, after some studies correlated HT with a significant increase in coronary diseases, breast cancer, stroke, and thromboembolism,[11] many women discontinued HT. Since that time, hormonal treatment has become much more individualized, with the physician and the patient considering its risks and benefits. Therefore, an increasing number of women have opted for other kinds of treatment,[12] such as increasing soy in the diet and using acupuncture and

yoga. Research is underway to assess the benefits of these unconventional, nonpharmacological resources.[13]

Some researchers have investigated the use of yoga for the relief of climacteric symptoms, which include hot flashes, insomnia, depression, and anxiety.[14-18] Other studies have also evaluated the value of yoga for treating symptoms such as depression, anxiety, and insomnia in women undergoing psychiatric treatment and older women.[19-22]

Yoga is derived from the Sanskrit root *yuj*, which means "union." It is the union of the individual being (*jivatman*) with the universal being (*paramatman*). Yoga techniques originated in India and have developed over thousands of years.[23] Today, it is used to treat several illnesses, including joint pain, hypertension, and rheumatoid arthritis,[24-26] and to generally promote health.[21,27] The body positions in yoga are called *asanas*, the respiratory exercises are called *pranayama*, and the meditation is called *dhyana*. Despite its Indian origin, the number of practitioners of yoga in the West is growing quickly. In 2002, 62% of adult North Americans used some kind of alternative or complementary practice; 5.1% of these practiced yoga.[28]

However, because there are many branches of yoga that offer different methodologies, it is hard to standardize the studies of yoga and generalize their results. Some kinds of yoga are essentially meditative, whereas others focus on breathing exercises. Likewise, some studies include only respiratory techniques, whereas others address the positions.

The aim of the present study was to evaluate the effects of a standardized yoga practice as a nonpharmacological treatment of the physical and mental health and the climacteric symptoms of postmenopausal women with a diagnosis of insomnia.

METHODS

Sample collection

Study participants were postmenopausal, literate women between the ages of 50 and 65 years with insomnia diagnosed by a specialist based on *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria. They had had amenorrhea for 1 year or longer, had follicle-stimulating hormone levels equal to or greater than 30 mIU/mL, and had a body mass index lower than 30 kg/m^2. The participants were recruited via print media (local newspaper) and through the outpatient service for climacterium provided by the Gynecological Endocrinology Clinic in the Department of Gynecology at the Universidade Federal de São Paulo–Escola Paulista de Medicina.

The exclusion criteria were as follows: uncontrolled clinical illnesses, such as systemic arterial hypertension, diabetes, and cancer; use of HT; use of psychotropic drugs; an apnea-hypopnea index greater than 15; and participation in psychological treatment of menopausal symptoms. The Committee of Ethics in Research of the Universidade Federal de São Paulo approved the study (CEP 0408/07).

Groups

A total of 213 women showed interest and were invited to a lecture on sleep disorders in women. They were then selected based on the inclusion/exclusion criteria and randomly assigned to groups. All of the volunteers provided written informed consent. The study lasted 4 months; questionnaires were completed before the study began and at the end of the study. All three groups ingested a daily dose of 500 mg of calcium, because the ethics committee of our university recommends at least one intervention for control groups. At the time of randomization, the groups had similar scores on the following scales: the Beck Anxiety Inventory (BAI), the Beck Depression Inventory (BDI), the Kupperman Menopausal Index (KMI), the Insomnia Severity Index (ISI), the Menopause-Specific Quality of Life Questionnaire (MENQOL), and Lipp's Inventory of Stress Symptoms for Adults (ISSL). They were also similar with regard to body mass index and age.

Control group (no procedure)

The researchers contacted 15 volunteers by telephone once a month to determine whether they were taking any drugs or following any procedures that could exclude them from the study. All of the volunteers were invited to participate in the yoga class procedure after the study ended.

Passive stretching

The 14 volunteers in this group had two 1-hour sessions per week of passive stretching. If a volunteer missed a session, she was asked to complete it on another day and/or at another time so that all of the participants would finish the 4 months of intervention without a significant number of absences. The volunteer would lie on a stretcher, first on her back and then on her stomach, and the main articulations in her body would be manipulated, with a soft stretching of the main muscles of those articulations. The stretches included circumduction of the ankle; flexion and extension of the knee; adduction, abduction, flexion, extension, and circumduction of the thigh; flexion and extension of the elbow; flexion, extension, and circumduction of the shoulder; flexion and extension of the wrist; and flexion of the neck. The passive stretching was performed by a physical therapist. One volunteer had to be excluded at the end of the study because she did not answer the final questionnaires.

Yoga

The yoga group's classes were led by a yoga teacher. The 15 volunteers were divided into groups of no more than three women, none of whom had had any previous experience with yoga. They completed two sessions a week that lasted 1 hour each. If a volunteer missed a session, she was asked to make it up on another day so that all of the participants would finish the study without a significant number of absences. The yoga sequence used was based on *yogasana* and some Tibetan techniques and is known as yoga HT for menopause. The technique uses stretching positions (*asanas*) along with strong and fast breathing, called bellows breathing (*bhastrika*). The practice ended with a directed relaxation.[29]

Questionnaires

The following questionnaires were used in the study: the BAI, which evaluates anxiety symptoms on four levels

ranging from 0 (not at all) to 3 (severely); the BDI, which comprises 21 questions that assess depressive symptoms on a scale from 0 to 3, in which a higher score indicates more severe symptoms[30]; the KMI, an instrument based on the weight/size addition of climacteric symptoms rated on a scale of mild, moderate, or severe[31]; the ISI, a questionnaire that evaluates the last 2 weeks of sleep, in which a higher score indicates more severe insomnia[32]; the MENQOL,[33] a questionnaire with 32 items scored from 0 (not at all bothered) to 6 (extremely bothered); and ISSL, which evaluates the physical and psychological symptoms related to stress levels in the last 24 hours (alert phase), the last week (resistance phase), or the last month (exhaustion phase).[34] A psychologist who was not involved in the study administered the questionnaires at the beginning of treatment and 4 months after the intervention.

Polysomnography

Overnight recording polysomnography was performed in the sleep laboratory using the Sleep Analyzing Computer, version 8.1 (Embla). The examination included an electroencephalogram, an electromyogram of the submental and tibial regions, an electrooculogram, an electrocardiogram, measurements of oronasal airflow and thoracic-abdominal movement, and a recording of body position and oximetry. After the examination, a physician who specializes in polysomnography evaluated the sleep stages according to the criteria described by Rechtschaffen and Kales.[35] The respiratory events, awakenings, and periodic limb movements were analyzed according to the criteria established by the Committee of the American Academy of Sleep Medicine.[36] The volunteers slept in the laboratory two nights for data collection: one night before the intervention and one night 4 months later.

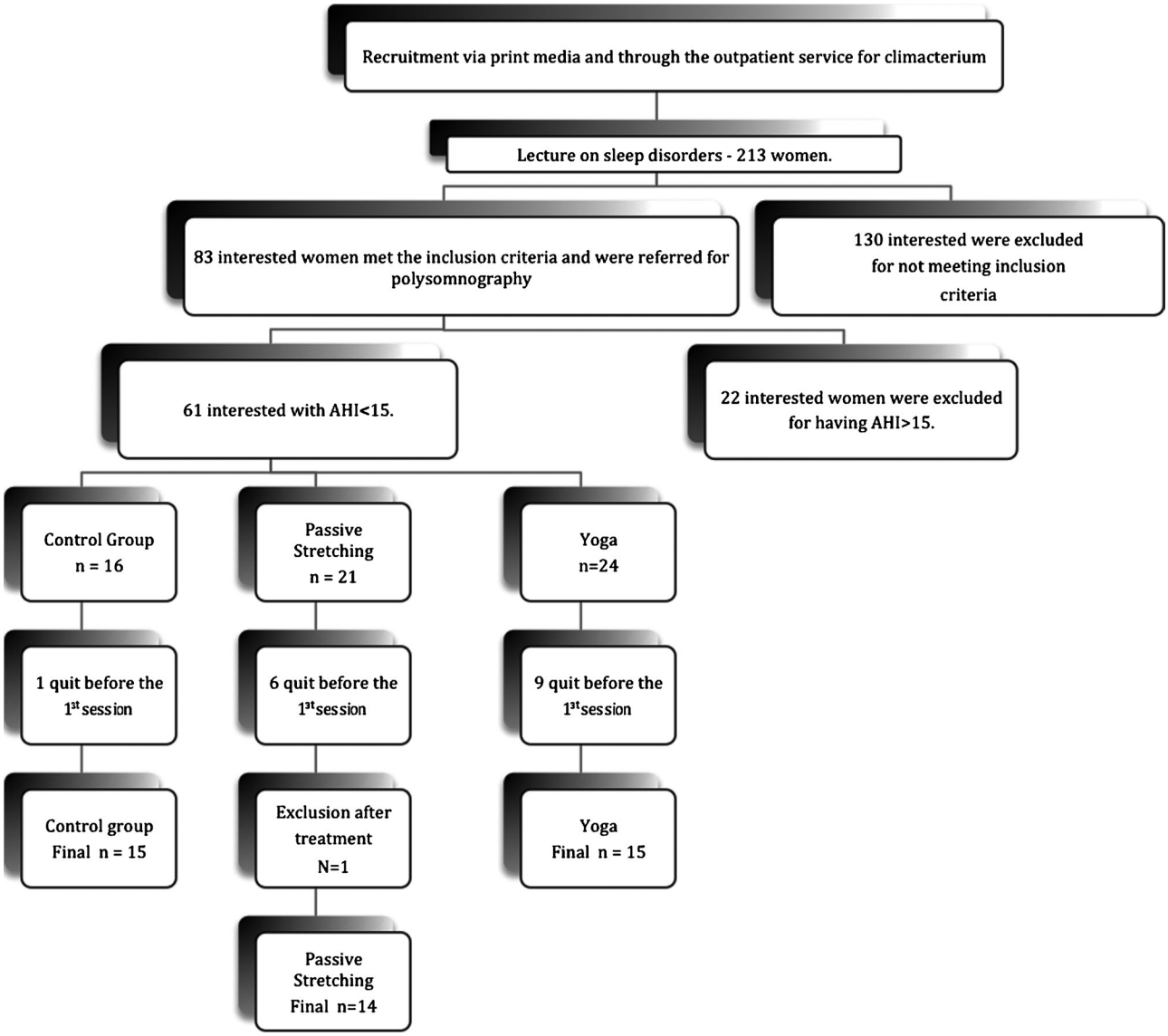

FIG. 1. Flow sheet regarding the participants in all phases of the study. AHI, apnea-hypopnea index.

TABLE 1. *Results of questionnaires scores*

	Control group				Passive stretching				Yoga			
	Pre		Post		Pre		Post		Pre		Post	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
BAI	13.7	2.5	13.5	1.9	12.2	2.5	10.2	1.9	15.3	2.5	8.8[a]	1.9
BDI	16.8	2.0	14.8	1.9	12.4	2.1	10.9	1.9	15.1	2.0	11.0[a]	1.9
KMI	22.3	2.6	19.9[b]	2.1	18.1	2.7	14.6	2.2	17.4	2.6	12.4[a,b]	2.1
ISI	15.2	1.2	13.7[b,c]	1.2	1.9	1.2	11.4[a,c]	1.3	14.1	1.2	9.7[a,b,c]	1.2
MENQOL	134.6	11.2	127.2[b]	10.8	114.6	11.6	101.6	11.1	118.5	11.2	88.1[a,b]	10.8
ISSL (alert)	5.5	0.6	4.1[a]	0.7	4.5	0.6	3.9	0.7	3.9	0.6	2.6[a]	0.7
ISSL (resistance)	7.5	0.8	7.2[b]	0.7	5.6	0.9	5.1	0.7	6.0	0.8	4.1[a,b]	0.7
ISSL (exhaustion)	10.1[d]	1.2	7.4	0.9	5.6[d]	1.3	4.6	0.9	8.1	1.2	5.2[a]	0.9

Comparison between pretreatment and posttreatment of three groups: control, passive stretching, and yoga ($P < 0.05$). Pre, pretreatment; Post, posttreatment; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; KMI, Kupperman Menopausal Index; ISI, Insomnia Severity Index; MENQOL, Menopause-Specific Quality of Life Questionnaire; ISSL, Inventory of Stress Symptoms for Adults.
[a]Comparison between the preintervention and postintervention moments of each group.
[b]Comparison of the groups in the postintervention moment.
[c]Comparison if the effect of treatment had difference between groups.
[d]Comparison of the groups in the preintervention moment.

Statistical analysis

The statistical program SPSS (version 17 for Windows) was used for the data analyses. Means and SDs were used to characterize the groups. A general linear model of repeated measures was used to investigate the effects on the scores of the questionnaires.

RESULTS

Of the 213 women who initially contacted our service, 83 met the inclusion criteria and were referred for polysomnography. Of these, 22 volunteers were excluded for having an apnea-hypopnea index greater than 15. Before the intervention, some volunteers left after they had been allocated to the groups. One volunteer in the control group had no interest in the study and, therefore, did not begin the procedure. Six volunteers did not begin the group passive-stretching sessions: one was excluded because she began treatment with fluoxetine, one was not interested, two volunteers did not have the time availability, one volunteer had her period, and one volunteer had a health problem and began a treatment program that prevented her from remaining in the study. Nine volunteers in the yoga group did not begin the treatment because of the following reasons: three of them lived too far from the location where the procedure was conducted, three did not have the time availability, two had no interest, and one left without providing any justification. No adverse effects were reported for the procedures (Fig. 1).

Forty-four volunteers enrolled in and completed the study. The passive-stretching group had a significantly lower score for the exhaustion phase of stress when compared with the control group, but not with the yoga group; however, no other differences were detected among the groups in the pretreatment stage (Table 1).

The evaluation of the treatment effect for each group when the pretreatment and posttreatment stages were compared showed that the yoga group experienced major improvements in the parameters evaluated, including a significant reduction in their BAI, BDI, KMI, ISI, and MENQOL scores and in the three phases of stress (alert, resistance, exhaustion) evaluated by the ISSL. The passive-stretching group had a significant reduction only in the ISI score, whereas the control group had a small but significant reduction in the symptoms of the alert phase of stress (Tables 1 and 2).

In evaluating only the posttreatment phase, the yoga group did not differ from the passive-stretching group in any of the parameters. It did, however, present significantly lower KMI,

TABLE 2. η *and observed power (OP) of the applied questionnaires (intragroup and between-group comparison)*

	Intragroup comparison								Between-group comparison							
	Before × After				Time × Group				Before				After			
	F	*P*	η	OP	*F*	*P*	η	OP	*F*	*P*	η	OP	*F*	*P*	η	OP
BAI	5.56	0.02	0.12	0.63	2.29	0.11	0.10	0.44	0.37	0.69	0.02	0.11	1.63	0.21	0.07	0.32
BDI	6.65	0.01	0.14	0.71	0.69	0.51	0.03	0.16	1.15	0.33	0.05	0.24	1.37	0.27	0.06	0.28
KMI	9.02	0.01	0.18	0.84	0.41	0.67	0.02	0.11	1.02	0.37	0.05	0.22	3.23	0.05	0.14	0.58
ISI	29.51	0.00	0.42	1.00	2.85	0.07	0.12	0.53	1.51	0.23	0.07	0.30	2.52	0.06	0.11	0.48
MENQOL	8.33	0.01	0.17	0.80	1.42	0.25	0.07	0.29	0.88	0.42	0.04	0.19	3.39	0.02	0.14	0.61
ESS	0.06	0.81	0.00	0.06	1.16	0.32	0.05	0.24	0.13	0.88	0.01	0.07	1.13	0.33	0.05	0.24
ISSL (alert)	972	0.01	0.19	0.86	0.54	0.59	0.03	0.13	1.68	0.20	0.08	0.33	1.49	0.24	0.07	0.30
ISSL (resistance)	3.79	0.06	0.09	0.48	1.25	0.30	0.06	0.26	1.30	0.29	0.06	0.27	4.97	0.01	0.20	0.78
ISSL (exhaustion)	20.18	0.01	0.33	0.99	1.49	0.24	0.07	0.30	3.32	0.05	0.14	0.60	2.66	0.08	0.12	0.50

BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; KMI, Kupperman Menopausal Index; ISI, Insomnia Severity Index; MENQOL, Menopause-Specific Quality of Life Questionnaire; ISSL, Inventory of Stress Symptoms for Adults; ESS, Epworth sleepiness scale.

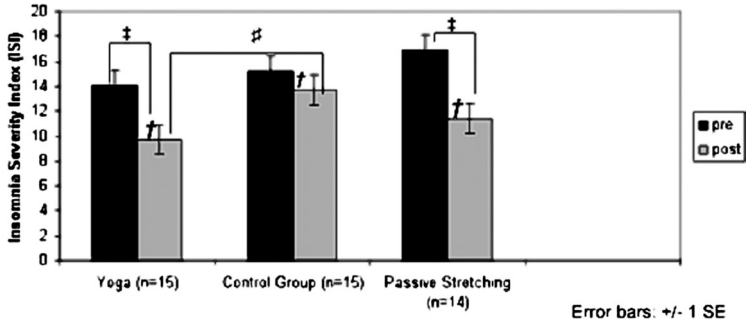

FIG. 2. Results of pretreatment and posttreatment ISI scores for the three groups: control, passive stretching, and yoga. ‡Comparison between the preintervention and postintervention time points for each group; †comparison of the effect of treatment between groups; #comparison of the groups at the postintervention time point ($P < 0.05$). ISI, Insomnia Severity Index.

ISI, MENQOL, and ISSL resistance phase scores when compared with the control group.

The ISI had a time × group interaction; that is, the three groups had simultaneously significant effects (Fig. 2). Figure 3 shows that both the yoga and the passive-stretching groups improved after treatment. However, only the yoga group presented with a significant difference in the ISI scores posttreatment when compared with the waiting-list control group, thus presenting with better results than the passive-stretching group.

Figure 3 shows that there was a significant difference between the yoga and control groups in the posttreatment KMI scores. Regarding quality of life, a significant reduction can be observed in the MENQOL scores of the yoga group compared with the control group (Fig. 4).

The polysomnography did not detect significant intergroup or intragroup differences.

DISCUSSION

Sleep disorders are highly prevalent in menopause, affecting between 28% and 63% of women.[7,37-39] Insomnia is related to lower quality of life[40] and a higher frequency of comorbidities.[41,42] The present study found that yoga yielded the best results for reducing postmenopausal insomnia-related complaints. This is the first study in the literature that demonstrates the benefits of yoga for postmenopausal women diagnosed with insomnia.

Many women discontinue HT because it is contraindicated or because they choose to after experiencing vasomotor symptoms. Many of them resort to alternative and complementary practices in their search for relief of their unpleasant symptoms.[43] Vasomotor symptoms are the most common complaint among climacteric women, and they are also the factor that most threatens their well-being. These symptoms can trigger a "domino effect," leading to other symptoms, such as insomnia and depression, and can negatively affect the quality of life of the women who experience them.[44] The results of the present study corroborate those of previous research, in which women who practiced yoga experienced a reduction in climacteric symptoms.[15,45] The MENQOL and the KMI scores showed significant posttreatment differences between the yoga group and the control group, and the yoga group showed significant improvement in their sleep and mental health, as assessed by analysis of pretreatment and posttreatment scores. Comparisons with the passive-stretching group showed no such effect. Carson et al[46] compared a yoga group with a wait-list control of women with breast cancer, a population whose climacteric symptoms are exacerbated and for whom HT is contraindicated. They observed a reduction in climacteric symptoms, which included severity and frequency of hot flashes, joint pain, fatigue, sleep disorders, and low vitality. Similar findings were found in a pilot study[17] in which a yoga sequence was used to treat menopausal symptoms in 12 women between 45 and 60 years old. The women in that

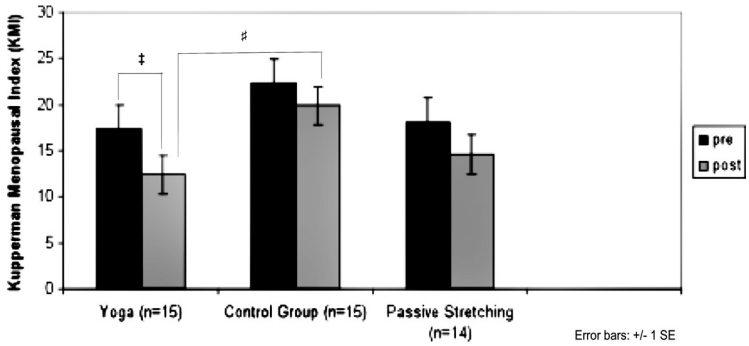

FIG. 3. Results of the preintervention and postintervention KMI scores for the three groups: control, passive stretching, and yoga. ‡Comparison between the preintervention and postintervention time points for each group; #postintervention comparison of the groups ($P < 0.05$). KMI, Kupperman Menopausal Index.

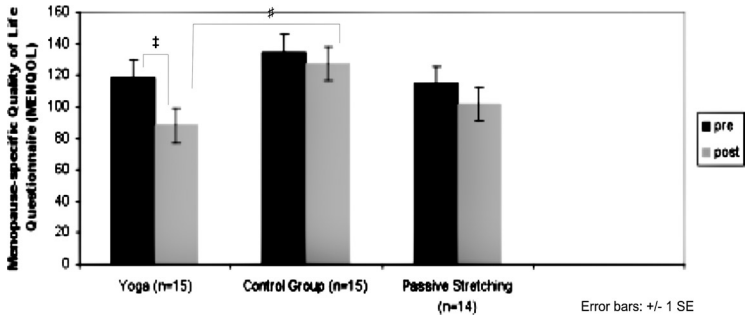

FIG. 4. Preintervention and postintervention MENQOL scores for the three groups: control, passive stretching, and yoga. ‡Comparison between the preintervention and postintervention time points for each group; #postintervention comparison of the groups ($P < 0.05$). MENQOL, Menopause-Specific Quality of Life.

study had a reduction in the symptoms of the menopausal transition, according to the Wiklund Symptom Checklist, and had improvements in quality of sleep (evaluated subjectively), sleep efficiency, sleep disorders, and global sleep quality, according to the Pittsburgh Quality of Sleep Index. Although those studies detected sleep pattern improvements, these interventions did not work with women diagnosed with insomnia. Cohen et al[18] reported a similar effect in a pilot study with women who had moderate-to-severe hot flashes. Our study also detected improvement in hot flashes and pain on the KMI and reduced ISI scores. The program was so successful that 75% of the volunteers continued doing yoga after the intervention. The sleep improvement in the studies mentioned above might be partially related to the symptoms presented by the volunteers in those studies (mainly vasomotor symptoms) because they may cause a worsening of sleep quality.[47]

Two other studies have reported similar results related to the quality of sleep in the older individuals. Researchers have observed that, with regard to sleep parameters, a yoga group responded better than did both an ayurveda group (who ingested an Indian compound of medicinal herbs) and a wait-list control.[21] The yoga group also had improved sleep when compared with a group that performed physical exercise.[22]

We hypothesize that the improvements our volunteers experienced were probably due to alterations in the central, autonomic, and neuroendocrine nervous systems.[48-50] Brown and Gerbarg,[51] in a comprehensive literature review, postulated a neurophysiological model for yoga's treatment of stress, anxiety, and depression. According to the authors, there is an increase in autonomic tone and systems of response to stress, a reduction in chemoreflex sensitivity, an increase in the sensitivity of the baroreflex response, a predominance of the parasympathetic system via vagus nerve stimulation, a synchronization of the cortical areas mediated by the thalamic nuclei, a reduction in the cortical areas involved in executive functions, an activation of the limbic system, and an increase in the secretion of prolactin and oxytocin. Research conducted with a homogeneous sample of individuals from the military who were given doses of melatonin[49] detected an increase in the levels of that hormone, which plays an important role in sleep and is a regulator of biological rhythms, in the group that had practiced yoga.[52-54] There are data to suggest that the practice of yoga leads to an increase in the brain concentrations of γ-aminobutyric acid, a potent inhibitory neurotransmitter.[50] All of these alterations lead us to believe that yoga plays an important role in the neuroendocrine and autonomic nervous systems, reduces sympathetic tone, and increases parasympathetic tone,[55,56] factors that may improve sleep patterns and contribute to reduced vasomotor symptoms.

With regard to anxiety and depression, the yoga group showed a trend toward a reduction in the BDI and BAI scores. There was an intragroup improvement, with no significant difference when compared with the passive-stretching and control groups. This may have been due to the small sample size. In addition, the BDI and BAI scores were not high initially. Thus, the volunteers in the sample were not depressed or anxious at baseline. Other studies in women with anxiety disorders and depression have concluded that yoga has a positive result in reducing these symptoms.[29,57-59]

We observed that the passive-stretching group showed a trend toward scores between those of the yoga group and those of the control group. Benson[60] described a state of calmness known as the relaxation response (as opposed to the fight-or-flight response), during which there are reductions in metabolism, heart rate, blood pressure, respiratory rate, and muscle tension, among other effects. Because the women in the passive-stretching group were lying on a stretcher and being touched and moved, they might have accessed the relaxation response state, resulting in a trend toward reduced symptoms, and, therefore, did not show significant changes when compared with the yoga group. Considering that there was a time × group interaction and that there was a difference between the groups, both the yoga and the passive-stretching groups improved after treatment. However, it is important to highlight that only the yoga group had a significant post-treatment difference in ISI scores, as compared with the control group. In the comparison between the preintervention and postintervention time points for each group, only the yoga group improved on all measures: anxiety, depression, menopausal symptoms, stress, and insomnia symptoms. Unlike the yoga group, the passive-stretching group did not have any posttreatment differences when compared with the control group. Therefore, it is possible to conclude that the yoga group had better results than the passive-stretching group.

Polysomnography did not detect significant differences between groups. The clinical diagnosis of insomnia is subjective. It takes the patients' complaints[61] into consideration because there are no insomnia-specific examinations that can be used. Hachul et al[3] have also observed predominantly subjective improvements in insomnia in a group treated with HT.

With respect to stress, the results of this study are in line with those of another study, in which women experienced a reduction in stress and salivary cortisol levels after a 3-month yoga program,[62] and with those of a study of workers who practiced yoga in their workplaces.[63]

CONCLUSIONS

The results of this study, the first involving postmenopausal women with a diagnosis of insomnia, highlight the improvement in sleep quality obtained in volunteers who practiced yoga for 4 months. There are few studies in the literature that have studied yoga in the context of menopausal symptoms or insomnia. Overall, there are few studies of yoga that have used rigorous, controlled, and randomized study designs. This randomized, controlled study of yoga highlights the efficacy of a specific sequence of yoga exercises in improving insomnia symptoms, sleep quality, and menopausal symptoms in postmenopausal women with a diagnosis of insomnia.

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