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Mind-body Therapies for Menopausal Symptoms: A Systematic Review

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Abstract

Objective—To systematically review the peer-reviewed literature regarding the effects of self-administered mind-body therapies on menopausal symptoms.

Methods—To identify qualifying studies, we searched 10 scientific databases and scanned bibliographies of relevant review papers and all identified articles. The methodological quality of all studies was assessed systematically using predefined criteria.

Results—Twenty-one papers representing 18 clinical trials from 6 countries met our inclusion criteria, including 12 randomized controlled trials (N=719), 1 non-randomized controlled trial (N=58), and 5 uncontrolled trials (N=105). Interventions included yoga and/or meditation-based programs, tai chi, and other relaxation practices, including muscle relaxation and breath-based techniques, relaxation response training, and low frequency sound-wave therapy. Eight of the nine studies of yoga, tai chi, and meditation-based programs reported improvement in overall menopausal and vasomotor symptoms; six of seven trials indicated improvement in mood and sleep with yoga-based programs, and four studies reported reduced musculoskeletal pain. Results from the remaining nine trials suggest that breath-based and other relaxation therapies also show promise for alleviating vasomotor and other menopausal symptoms, although intergroup findings were mixed. Most studies reviewed suffered methodological or other limitations, complicating interpretation of findings.

Conclusions—Collectively, findings of these studies suggest that yoga-based and certain other mind-body therapies may be beneficial for alleviating specific menopausal symptoms. However, the limitations characterizing most studies hinder interpretation of findings and preclude firm conclusions regarding efficacy. Additional large, methodologically sound trials are needed to determine the effects of specific mind-body therapies on menopausal symptoms, examine long-term outcomes, and investigate underlying mechanisms.

Keywords

Mind-body therapies; yoga; meditation; relaxation; breathing; tai chi; menopause; climacteric; vasomotor

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INTRODUCTION

An estimated 75 to 85% of women experience some or all symptoms of menopause [1–2], including vasomotor disturbances (hot flashes/night sweats), fatigue, sleep impairment, mood disturbances, cognitive difficulties, musculoskeletal pain, and headaches [3–5]. Symptoms typically begin at least one year prior to menstrual period cessation and persist for several years post-menopause; for example, findings from a recent meta-analysis indicate that approximately 50% of women continue to experience vasomotor symptoms 4 years after their final menstrual period [6] with reported average duration of vasomotor symptoms ranging from 3.8 [7] to over 7 years [6]. Approximately 10–30% of postmenopausal women will continue to experience symptoms throughout their lives; in breast cancer survivors, symptoms are often more frequent or severe due to endocrine therapy and chemotherapy-induced menopause [8–9]. Symptoms can result in significantly reduced quality of life that for some can be debilitating [10], prompting an estimated 60% of women to seek medical treatment [11]. Given that there are over 50 million women in the US aged 50 or older [12], with at least 1.5 million reaching menopause every year, the financial, social, and psychological burden of menopause is considerable [13–14].

While hormone replacement therapy (HRT) has long been prescribed to alleviate hot flashes and other menopausal symptoms, HRT use has fallen dramatically in both the US and Europe due to evidence from recent large clinical trials that HRT increases risk for breast and endometrial cancer, coronary artery disease, stroke, and thromboembolism [14–18]. An increasing number of women are turning to complementary and alternative therapies to help manage menopausal symptoms [19], with current estimates ranging from 40% to over 70% of women in the peri- and postmenopausal period [19–21]. Among the more commonly chosen therapies are mind-body practices, including active disciplines such as yoga and tai chi, as well as specific relaxation and other stress management techniques [19–20]. Given that menopausal symptoms both contribute to and are exacerbated by psychosocial stress [22–23], and a growing body of literature suggests mind-body practices can reduce perceived stress and stress reactivity, enhance mood and wellbeing, and improve sleep [24–27], mind-body therapies may have promise for the management of menopausal complaints. Moreover, several mind-body therapies (including yoga, meditation, qigong, tai chi, and several relaxation techniques) have been reported to decrease indices of sympathetic activation [25,28–30], factors that characterize and may in part underlie the development and exacerbation of vasomotor and other menopausal symptoms [7]. These factors may also play an important etiologic role in the development of insulin resistance, dyslipidemia, hypertension, and other atherogenic changes associated with menopause [25].

In this systematic review, we critically evaluate available evidence from the published scientific literature regarding the effects of self-administered mind-body therapies on common menopausal symptoms. We also briefly discuss possible mechanisms that may underlie observed benefits, outline major limitations in the current literature, and detail directions for future research.

METHODS

Included in this review are original clinical trials published in the peer-reviewed scientific literature regarding the effects of any self-administered mind-body therapy (representing a broad range of relaxation and stress-reduction therapies, including, among others, biofeedback, imagery, yoga and meditation, breathing exercises, tai chi, qigong, Pilates, mindfulness-based stress reduction programs, progressive muscle relaxation, and related programs) on menopausal symptoms. We excluded studies that evaluated only conventional exercise or cognitive behavioral therapy programs, did not specifically target menopausal

symptoms, or were not available in English. Cross-sectional studies, case series, and case studies were excluded, as were trials published only in dissertation or abstract form or that did not report quantitative outcome data.

To identify potentially eligible studies, we searched 10 scientific databases from their inception through November 2009 for clinical trials regarding the effects of mind-body therapies on menopausal symptoms, including MEDLINE, CINAHL, Academic Search Complete, Cochrane Library (Cochrane Central Register of Controlled Trials), PsycINFO, PsycARTICLES, Alt HealthWatch, IndMED, Health Source: Nursing/Academic Edition, and SPORTDiscus with Full Text. Search terms included: [relaxation OR yog\$ OR breathing OR pranayam\$ OR mind body OR mind-body OR pilates OR qigong OR tai chi OR tai ji OR imagery OR meditation OR mindfulness OR progressive muscle OR dance OR stretch\$ OR biofeedback OR complementary therap\$ OR alternative therap\$ OR health promotion OR physical activity] AND [menopaus\$ OR peri-menopaus\$ OR post-menopaus\$ OR climacter\$ OR vasomotor OR hot flash\$ OR hot-flash\$ OR hot flush\$ OR hot-flush\$ OR night sweat\$ OR sleep OR depression OR anxiety OR mood OR pain OR ache OR fatigue]. Titles and abstracts of the citations were scanned to identify potential articles for the review. In addition, we manually searched our own files, the citation sections of all identified articles, and the reference sections of recent (2000–2010) review articles concerning treatment for menopausal symptoms. Potentially eligible papers were retrieved in hard copy form for more detailed review.

Data extraction for each eligible paper were performed by at least two of the three authors according to predefined criteria, and recorded on standardized forms. Study quality was evaluated using predefined criteria based on those utilized in recent systematic reviews regarding the effects of mind-body therapies [31–32]. Criteria included (i) adequate sample size; (ii) explicit eligibility criteria and/or adequate description of study population; (iii) single, well-defined intervention; (iv) appropriate control group(s) or comparison condition(s); (v) randomization of treatment allocation, method used to generate the allocation sequence described and appropriate, random allocation sequence concealed until group assignment was made; (vi) blinding of outcome assessment; (vii) outcome measures appropriate, well-defined and validated; (viii) statistical methods well described and appropriate, with point estimates and measures of variability presented; (ix) dropouts/withdrawals reported and less than 25%; (x) compliance reported and adequate; (xi) adequate accounting for confounders; and (xii) conclusions supported by findings. Discrepancies or disagreements during the data extraction and evaluation process were resolved by discussion and consensus by at least two reviewers (KEI and TKS).

Due to the heterogeneity in content, duration, intensity, and delivery methods of the intervention, no meta-analyses were performed. However, to provide a clinically meaningful estimate of effect size and allow comparison across studies, we calculated, for each study, percent change from baseline to post-intervention (and follow-up when appropriate) in specific measures of common menopausal symptoms.

RESULTS

Of over 3500 potentially relevant abstracts and citation indices scanned, 54 possibly eligible papers were identified for detailed review; of these, 33 were excluded for the following reasons: 11 did not involve an eligible mind-body therapy as a central component, 2 did not present original data or reported data included in another paper, 4 used an ineligible study design, 1 was an unpublished trial, 3 were not available in English, and 12 did not target symptoms of menopause. A total of 21 papers representing a total of 882 participants over 18 trials from 6 countries are included in this review, including 12 randomized controlled

trials (RCTs) (N = 719 total participants), 1 non-randomized controlled trial (NRCT) (N = 58 total participants), and 5 uncontrolled trials (UCTs) (N = 105 total participants). Participants included 249 breast cancer patients. Most studies were conducted recently, with only 6 trials (all RCTs) published prior to 2004. Trials included five UCTs of yoga [33–35] and/or meditation-based programs [36–37], one NRCT of tai chi [38], three RCTs of yoga [39–43], and nine RCTs of other relaxation practices as follows: muscle relaxation techniques [44–47]; breath-based techniques (slow paced respiration [48–49], deep breathing with guided imagery [50] plus muscle relaxation [51]); relaxation response training [52]; and low frequency sound audiotape [53]. Characteristics of the studies, key outcomes, and major findings are detailed in Table 1. Percent change noted in specific measures of menopausal symptoms are given in Table 2.

Yoga, an ancient discipline of the mind, body, and spirit originating in India at least 4000 years ago, incorporates physical poses, breathing exercises, and meditation to calm the mind, increase awareness, and enhance both mental and physical health [25]. Mindfulness Based Stress Reduction (MBSR) is a multi-component program first developed in the late 1970's by Jon Kabat-Zinn that combines the ancient practices of yoga and mindfulness meditation to cultivate awareness and reduce stress, typically including breathing, stretching, and other relaxation exercises [54]. Originating in China centuries ago, tai chi uses slow, flowing, dance-like body movements, coupled with deep breathing to achieve mental and physical balance, relaxation, focus, and awareness [25]. Paced breathing refers to slow, deep, abdominal breathing [48], similar to that taught in yoga and other meditative disciplines. Progressive muscle relaxation, developed by Edmund Jacobson in the early 1920s [55], is a technique for reducing stress and inducing calm by alternately tensing and relaxing the muscles. Building on existing muscle relaxation techniques, Applied Relaxation was developed in the late 1970's to train individuals to relax rapidly even when exposed to anxiety-provoking situations [56]. Introduced in the 1970's by Herbert Benson, the relaxation response can be elicited by sitting quietly, adopting a passive disregard of distracting thoughts, and focusing on the breath or a simple repeated sound, word, or prayer (as in yogic breath-based and mantra meditation), to induce a state of deep rest that reduces the physical and emotional responses to stress, enhances well-being, and promotes calm [57].

Yoga, Tai Chi, and Meditation-Based Programs

Our search identified 8 studies (10 articles) assessing the effects of yoga and meditation-based programs on symptoms of menopause, including 3 RCTs and 5 UCTs from 4 countries. As illustrated in Table 1, interventions ranged from 7 [36] to 16 [42–43] weeks ($\bar{x}=9.6\pm3.0$ weeks) in duration and included both yoga [33–35,39–43] and/or yogic meditation [37] alone and in combination with educational and/or other co-interventions [36,39–41], including one uncontrolled study of mindfulness based stress reduction (MBSR) [36]. Classes ranged in frequency from 1–2 [33–34,36–37,39,42–43] to 5 sessions per week [40–41], with home practice varying from casual [42–43] to daily structured practice [33,36–37,39]. Trials include 7 studies (5 UCT, 2 RCT) of healthy pre-, peri- and postmenopausal women and 1 RCT of breast cancer survivors [39] (Table 1), including a total of 426 participants (105 in UCTs, 321 in RCTs). Three studies, 2 UCTs [36–37], and an RCT of breast cancer survivors [39], included a follow-up assessment 1–3 months after completion of the intervention. Findings regarding effects on specific menopausal symptoms and on symptoms overall are discussed briefly below.

Menopausal symptoms overall—Seven of the eight studies (including 4 UCTs [33–35,37] and 3 RCTs [39,41,43]) assessed change in symptom burden using structured 6–20 item menopausal symptom questionnaires (Table 1). Six of these seven studies report

significant attenuation of symptoms with yoga and meditation-based programs. For example, 4 of 4 uncontrolled studies of yoga [33–35] or yogic meditation [37] in healthy peri- and postmenopausal American [33–34], Australian [37], and Iranian women [35] indicated significant reduction in symptoms overall [33,37], and in vasomotor symptoms [33–35,37], musculoskeletal pain and other somatic symptoms [33–35,37], psychological distress [35,37], sleep disturbance [34–35], and other common symptoms [35] relative to baseline; findings from 2 studies suggest reduction in overall symptom burden [37], and particularly, in vasomotor symptoms [36–37] were retained at 1 month follow-up. Similarly, two RCTs, including a large 12-week, 2-arm study of Indian women (N=120) [41], and a smaller 8-week trial of breast cancer survivors (N=37) [39] reported significant improvement in menopausal symptoms, including vasomotor [39,41], mood ($p=0.06$) [41], symptom-related bother [39], and vigor [39] in participants assigned to a yoga vs. a comparable exercise program [41] or wait-list control [39]. Overall reduction in menopausal symptoms ranged from 36% [33,41] to 80% [37] depending on study design, study population, instrument used, and other factors (Table 2). Many of these improvements remained significant 3 months following program completion, including those in hot flashes, joint pain, mood, and vigor [39] (Table 1). In contrast, a recent 3-arm RCT of US women (N=164) comparing the effects of a gentle Iyengar yoga program vs. a moderate intensity exercise program and a usual care control did not demonstrate significant differences between the yoga and exercise group in either total symptoms or symptom domains [43]. However, the yoga program in this study (two 90-minute classes/week) was lower intensity than the exercise intervention (three 1-hour classes/week, plus individualized home exercise prescription 1–2 days/week, and home practice monitoring), class attendance was lower in the yoga vs. exercise group (63% vs. 70%, translating to an average of 20 vs. 34 classes, respectively) and participant attrition was substantially higher (40% for the yoga vs. 21% for the exercise group), possibly helping to explain the discrepancy in findings; moreover, the authors present only an intent-to-treat analysis, which, given the considerably greater attrition rates in the yoga group, would be expected to differentially bias effect sizes of the yoga intervention toward the null [58].

Vasomotor symptoms—Hot flashes and night sweats are among the most common and troubling menopausal symptoms [2,14], associated with physical discomfort, and with disturbances in sleep, mood, and cognition; up to 85% of women report experiencing hot flashes [2], with 33% or more symptomatic women experiencing at least 10 per day [1]. All 8 studies collected data on vasomotor symptoms, either specifically [33–34,36–37,40] and/or via menopausal symptom questionnaires [33–35,37,39,41,43] as indicated above. All but one study [43] reported improvement in vasomotor symptoms relative to baseline, usual care control, or physical activity. Uncontrolled studies of yoga [33–35], yogic meditation [37], and mindfulness-based stress reduction [36] reported significant reductions in night sweats [33], and in hot flash frequency [33–34,36–37], severity [34,36], and impact/interference in daily life/activities [33,35–37]. Likewise, two of three RCTs reported significant declines in vasomotor symptoms overall [41], and in hot flash frequency and severity [39], following participation in an 8–12 week yoga program vs. an exercise program [41] or usual care [39]. Observed percent reduction in overall symptoms ranged from 16 to 80% post-intervention and from 21 to 58% at follow-up depending on outcome measure and domain, study design, population, and intervention (Table 2).

Sleep Disturbance and Psychological Symptoms—Sleep impairment and mood disturbances, including increased anxiety, irritability, depressive symptoms, and other adverse psychosocial changes are common menopausal complaints [4–5,59]. Seven studies reported findings on sleep disturbance from either sleep-specific instruments [33–34,36,42] or menopausal symptom questionnaires [35,39–40]. Again, all but one of the 7 studies [42]

reported significant improvements in sleep among participants of yoga or meditation-based programs relative to baseline [33–36,40] or wait-listed controls [39]; compared to those completing a comparable exercise program, yoga group participants also showed marginally significant improvement in night sweat-related sleep disturbance ($p=0.08$) in a large RCT of Indian women [40].

Seven studies, including 4 UCTs and 3 RCTs, reported psychosocial outcome data from general menopausal [35,39] or mental health-specific [34,36–37,41,43] questionnaires. Six of the 7 trials (3 UCTs, 3 RCTs) reported significant pre-post improvement following an 8–12 week yoga or meditation-based program in psychological status, including overall psychological symptoms [35–37,41,43], anxiety [35–37], depression [35–36], perceived stress [36,41], vigor [36,39], symptom-related distress [39], and fatigue [35,39]. Controlled trials of healthy women [41,43] and breast cancer survivors [39] also indicated significant improvement in psychological status overall [41], and in positive affect [43], perceived stress [41], symptom-related distress [39], fatigue [39], and vigor [39] in participants assigned to yoga vs. usual care/wait-list [39,43] or to a comparable exercise program [39,41], with several of these differences persisting at 3-month follow-up [39]. (Table 1)

Other Menopause-related Symptoms—Other common symptoms of menopause include musculoskeletal pain [59], as well as impairments in memory and concentration [4,60]. Of the 8 studies reviewed here, four, including 3 UCTs in healthy women [33–35] and 1 RCT in breast cancer survivors [39] reported specific findings regarding muscle and joint pain; all indicated significant improvement in participants assigned to an 8–12 week yoga program relative to baseline [33–35] or wait-list control [39]. Only one study evaluated the effects of yoga on cognitive changes associated with menopause [40]; this large RCT of healthy Indian women demonstrated significant enhancement of both concentration and memory following a moderately intensive yoga program [40].

Tai Chi

While numerous studies have assessed the effects of tai chi on mental and physical outcomes in older adults [61–62], including older women [25,63], we identified only one study to date specifically evaluating the effects of tai chi on menopausal symptoms [38]. Although this NRCT in healthy Australian menopausal women included 3 arms ($N=58$, with 40 completing), only pre-post data are reported, indicating significant improvement in night sweats, hot flashes, abdominal discomfort, and fatigue following a 16-week tai chi program (Table 1). Findings indicate a 50% and 42% reduction in the number of women reporting hot flashes and night sweats, respectively, effects that appeared comparable to those of herbal therapy and acupuncture, although baseline values differed across groups [38].

In short, studies to date suggest that yoga and meditation-based programs may be beneficial in attenuating menopausal symptoms overall, in reducing hot flash frequency, intensity, and impact, in improving sleep and mood, and in decreasing stress and pain; a recent large RCT suggests yoga may also help enhance memory and concentration. However, interpretation of findings is hindered by methodological and other limitations characterizing most studies published to date, including lack of control group [33–37] or failure to control for non-specific effects of treatment [38–39], group assignment not random [38], method used to generate the allocation sequence not described or inappropriate [38], allocation sequence concealment not described [38,42–43], small sample size [33–34,36–39], unclear eligibility criteria and/or incomplete description of study population [35,37–38], poorly-defined intervention [38], blinding of outcome assessment not reported [38], outcome measures not well-defined and/or not validated [35,38], statistical methods incompletely described [35,37–38], intergroup comparisons not reported [38], point estimates or measures of

variability lacking on menopausal symptoms[37–38], attrition not reported or greater than 25% [36–38,42–43], compliance not reported [35,37–38] or less than 75% [42–43], and potential confounders (e.g., change in smoking, dietary intake, or other lifestyle factors known to influence menopausal symptoms) not specifically addressed [33–35,38].

Muscle relaxation, Slow/Paced Breathing, Relaxation Response, and Other Relaxation Therapies

We identified an additional 9 trials (10 published papers) from 3 countries evaluating the effects of muscle relaxation techniques, breathing practices, and other relaxation therapies on menopausal symptoms, all RCTs [44–53]. Interventions assessed included muscle relaxation (two Applied Relaxation [45–47] and two Progressive Muscle Relaxation studies [44,48]); breathing practices (two Paced Respiration [48–49] and one deep breathing with guided imagery [50]), one study combined deep breathing, guided imagery, and muscle relaxation [51]; Relaxation Response training using the breath as a mental focus (one study) [52]; and low-frequency sound wave therapy (one study) [53]. Trials include 5 studies of generally healthy menopausal and postmenopausal women [44–45,48–49,52,64] and 4 RCTs of women treated for breast cancer [46–47,50–51,53] (Table 1), including a total of 398 participants (186 healthy women, 212 women with breast cancer). Four studies, 2 RCTs of women undergoing treatment for breast cancer [46–47,51], and 2 RCTs of healthy menopausal and post-menopausal women [44–45,64] included a follow-up assessment 3–6 months after completion of the intervention. Findings of these studies are summarized in Tables 1–2 and detailed briefly below.

Menopausal symptoms overall—Three of the 9 trials [45–46,53,64], including 2 studies of women with breast cancer [46,53], assessed change in symptom burden using structured item menopausal symptom questionnaires (Table 1). All three studies reported alleviation of symptoms with relaxation therapy. For example, in 2 small Swedish trials of healthy postmenopausal women (N=30) [45] and women receiving treatment for breast cancer (N=38) [46], investigators reported significant declines relative to baseline in overall menopausal symptoms following a 12-week muscle relaxation program; these changes were maintained at 3–6 month follow-up, and appeared comparable overall to those observed following 12 weeks of electro-acupuncture[46] and 12 weeks plus continued treatment with estrogen therapy [45]. While the investigators did not include a placebo or attention control group in their original study of healthy post-menopausal women, a subsequent re-analysis incorporating data from a similar 12-week trial evaluating the effects of estrogen vs. placebo treatment suggested a significant improvement post-treatment in overall menopausal symptoms in the applied relaxation relative to the placebo group [64]. In a US trial of healthy menopausal women, Rankin reported significant decreases in total symptom frequency, somatic symptoms, and psychological symptoms in participants assigned to a two-week home audiotape program compared to usual care controls [53].

Vasomotor symptoms—Eight of the nine studies collected data on vasomotor symptoms via hot flash logs/diaries [44–47,50–52], finger temperature measurement [44], and/or ambulatory monitoring [48–49]. All studies reported within group improvement in hot flash frequency and/or severity among participants assigned to a 4–12 week program of muscle relaxation [44–47], breathing practices alone or as part of a combination therapy [48–51], or relaxation response training [52] although intergroup findings were mixed (Table 1). For example, of the five trials evaluating the effects of muscle relaxation alone or in combination with breathing exercises and/or other co-interventions [44–48,51], only two studies, a large trial of British breast cancer patients [51] and a small study of American menopausal women [44] indicated significant reduction in hot flash frequency [44,51], severity [51], and distress/interference [51] relative to usual care [51] or alpha-wave

feedback [44]; the two Swedish studies reported declines in hot flash frequency that were further reduced at 6-month follow-up, but were not superior to either estrogen [45] or acupuncture therapy [46]. A sixth (American) study assessing the effects of relaxation response training demonstrated no intergroup differences in hot flash frequency but reported significant improvement in hot flash severity relative to no change in a reading or usual care control group [52]; however, no intergroup analyses were presented. In the remaining two trials, along with the study that included both a paced respiration and a muscle relaxation arm, participants assigned to a 4–6 week program of breathing exercises showed significant reductions in hot flash frequency [48–50] relative to usual care [50], α -wave feedback [48–49], and/or muscle relaxation [48].

Psychological Symptoms—Five of the nine trials specifically assessed effects of relaxation therapies on affective symptoms of menopause [45,47,50–52], including three studies of women with breast cancer [47,50–51]. Again, findings were mixed (Table 1). Four of the five studies reported significant improvements in mood relative to baseline [45,47,50,52], although only one study reported significant improvement relative to controls [50]; two Swedish studies indicated improvements in mood that were sustained at 6 months, similar to those observed for estrogen treatment [45] or acupuncture [47].

Collectively these studies suggest that other relaxation therapies may have some promise for alleviating menopausal symptoms. However, interpretation of findings is compromised by the substantial limitations characterizing most of these studies, including failure to control for non-specific effects of treatment [50,53], small sample size [44–50,52–53], unclear eligibility criteria and/or inadequate description of study population [44,50,53], poorly-defined intervention [50], method used to generate the random allocation sequence not described or inappropriate [44–50], random allocation sequence not concealed until group assignment was made [48–49,52–53], outcome assessment blinding not reported [45–46,50,52], presentation of findings confusing or incomplete [45–46], intergroup comparisons not reported for menopausal symptoms [49,52], point estimates or measures of variability lacking [52], attrition not reported or 25% or greater [48–53], compliance not reported [44–49,52–53], and baseline differences or changes in lifestyle factors and/or other potential confounders not specifically accounted for [44–50,52–53].

DISCUSSION

The financial, health, and social costs of vasomotor disturbances and other menopausal symptoms are substantial and are projected to continue increasing in coming years with the progressive aging of populations in the U.S. and other western industrialized countries [13–14]. In response to publication of findings regarding serious adverse health effects of HRT, once widely prescribed for menopausal complaints, use of HRT has fallen dramatically [16]. In addition, use of HRT is generally contraindicated in certain populations, including breast cancer patients, for whom cancer treatment often leads to particularly severe vasomotor and other menopausal symptoms [65]. Thus, identification of alternative, safe and cost-effective therapies for alleviating menopausal symptoms is needed. As indicated above, recent research suggests that certain mind-body therapies may have potential utility in this regard. Collectively, studies to date offer modest evidence that yoga-based programs may be helpful in reducing common symptoms of menopause, including vasomotor, sleep, and mood disturbances, and that certain breath-based practices may be useful in reducing hot flashes. Additional research suggests that muscle and other relaxation therapies may also have some benefit for attenuating vasomotor and other common menopausal complaints, although interpretation of findings is complicated by the lack of a placebo/attention control. In addition, follow-up data available from 8 of the 18 existing studies indicate that the improvement in vasomotor and certain other symptoms observed with yoga [34,36–37,39]

and other mind-body therapies [44–46,51] may be sustained post-intervention. No adverse events were reported in the trials reviewed.

Also important to consider is that mind-body therapies may carry several advantages from the standpoint of safety, satisfaction, implementation, and possible ancillary social, psychological, and health benefits. Side effects and risks of mind-body practice are generally minimal, implementation costs are low, and most mind-body therapies can be performed by a broad range of populations, including overweight, sedentary, chronically ill, and elderly women [25,66–67]. The use of mind-body therapies to alleviate menopause symptoms is increasingly common [20,68], and satisfaction with the perceived therapeutic benefits of these practices is generally high [20,69]. In addition, a growing body of research suggests that mind-body practices may have multi-faceted effects on health, enhancing psychological, physiological, and physical function and well-being in both healthy and chronically ill individuals [25,67,70–72]. This is a particularly important consideration, in light of the sharp increase in risk for both CVD and osteoporosis that occurs with menopause [73–74]. This dramatic rise in chronic disease risk likely in part reflects the abrupt hormonal alterations, especially the decline in estrogen levels that occur during this period, along with the associated constellation of atherogenic, neuroendocrine, and metabolic changes linked to the insulin resistance syndrome. Menopause is associated with activation of the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nervous system [25], factors that have been linked not only to the development and exacerbation of menopausal symptoms [7,75], but also to the etiology and progression of CVD [25,76] and osteoporosis [77–78]. In fact, recent research suggest that vasomotor and other climacteric are strongly related to health functioning [79] and to adverse CVD profiles [75–76], and may themselves be important markers for chronic disease risk, reflecting changes in underlying health status [75–76].

Clearly, there is a need for safe, cost-effective, comprehensive therapies that alleviate climacteric symptoms without serious short or long term health sequelae, that encourage sustained compliance, and that reduce risk for the major chronic conditions associated with the menopausal transition- notably CVD and osteoporosis, inter-related disorders of major and growing public health significance [80–81]. As indicated above, mind-body therapies may have promise not only for mitigating the acute symptoms of menopause, but also for reducing longer term health effects of adverse neuroendocrine, metabolic, and cardiovascular changes associated with menopause [25]. These factors have, in turn, been strongly linked to CVD etiology and progression [25] and more recently (e.g., lipid profiles, oxidative stress, inflammation, psychosocial stress, and depression) to osteoporosis [82–86]. In addition, findings from a number of recent controlled studies in post-menopausal women suggest that tai chi may be instrumental in retarding bone loss [63,87–89], and increasing bone formation [87,90–91]; likewise, a recent RCT of qigong [92], and a small UCT of yoga [93], suggest that these practices may also prove beneficial in reducing bone loss.

Biological plausibility—While underlying mechanisms remain speculative, there are several ways in which mind-body practices could alleviate vasomotor and other symptoms of menopause. Yoga, tai chi, meditation, and other relaxation therapies have been reported to reduce sympathetic activity, decrease sympathoadrenal reactivity, and enhance parasympathetic output [7,25,94], which may, in turn, reduce the prevalence and severity of vasomotor disturbances, sleep impairment, and other common menopausal symptoms [7,75]. Mind-body practices may also attenuate climacteric symptoms by improving other indices of psychological and physical health. For example, several mind-body practices, including yoga, meditation, and tai chi have been reported to reduce body weight, body fat and weight gain, improve lipid profiles, decrease blood pressure, and alleviate stress and depressive

symptoms [24–25,29,31,95–97] which have, in turn, been associated with severity of hot flashes [75,79,98–99] and other menopausal symptoms [75–76,98–101]. Group and individual practice may also lead to beneficial changes in dietary intake, smoking, and other lifestyle factors that have been related to climacteric symptom severity [22,101–102]. Finally, pronounced placebo effects have been observed in trials evaluating complementary and alternative, and particularly nutraceutical, therapies for vasomotor and other symptoms of menopause [103–104]. However, as detailed above, several studies of mind-body therapies reported improvement in hot flashes and other climacteric symptoms relative to other plausible interventions, including exercise, reading, and alternative relaxation practices; a number of studies also indicated sustained benefits post-intervention, when the placebo effects would be expected to wane. Nonetheless, participant expectancies were reported in only one of the studies reviewed [39], and not all trials included comparison conditions that controlled for non-specific effects of treatment; thus, that placebo or other non-specific effects may in part account for the improvements observed cannot be ruled out, underscoring the need for further rigorous controlled trials.

Limitations in the Literature and Directions for Future Research

While collectively, studies to date suggest that certain mind-body therapies, including yoga-based programs, breathing practices, and other relaxation therapies may hold promise for reducing vasomotor and other symptoms of menopause, most suffer methodological and other limitations that preclude definitive conclusions regarding efficacy and render specific clinical recommendations premature. Several trials included in this review were uncontrolled, non-randomized, and/or lacked a comparison condition that controlled for potential non-specific effects of treatment. Sample sizes in most studies were small, with only 4 of the 18 trials including over 20 participants in the experimental treatment. Interpretation of most existing studies is also hampered by other limitations, including exposure to multiple interventions, high attrition rates or failure to report drop-outs, low or non-reporting of compliance, poorly defined or non-validated outcome measures, inadequacies in statistical analysis and presentation, or other methodological problems. Trials to date have also varied considerably in study design, study population, attrition and compliance, comparison group(s), outcome measures employed, and content, delivery, duration, and intensity of the intervention, rendering comparison across studies difficult. In addition, few studies have examined the long-term effects of mind-body therapies on vasomotor and other symptoms of menopause. While 8 of the 18 trials included in this review assessed at least some outcomes post-intervention, follow-up periods were relatively short, with none exceeding 6 months in duration, and only two studies [36,39] reported information on participant adherence post-intervention. In addition, the effects of several popular and potentially beneficial practices on specific menopausal symptoms remain little studied. For example, the effects of tai chi, qigong, and meditation-based programs on climacteric symptoms remain little explored, and rigorous, controlled studies are lacking, despite a growing body of literature suggesting that these practices may have a range of beneficial effects on both physical and mental health [25,63,105].

In light of the need for safe, cost-effective treatments for vasomotor and other troublesome menopausal symptoms, the current widespread and increasing use of mind-body therapies, and apparent therapeutic potential of these practices for both managing climacteric symptoms and mitigating the risk for CVD and osteoporosis that rises sharply with the menopausal transition, further research is clearly warranted regarding the possible benefits of promising mind-body therapies. In particular, there is a need for large, rigorous, methodologically sound controlled trials to examine the influence of standardized, well-defined mind-body therapy programs on well-validated measures of vasomotor and other common climacteric symptoms, to assess potential long-term benefits of and adherence to

these therapies, and to investigate possible meditating factors and underlying mechanisms. While placebo effects are unlikely to explain the substantial gains observed in previous controlled trials, the influence of expectancy, attention, and other non-specific effects can be substantial and is particularly important to consider in designing future studies. In the case of programs demonstrating clear, reproducible, improvement of symptoms in climacteric women, the development and evaluation of strategies to promote long-term maintenance of practice and associated benefits, perhaps the biggest challenge in lifestyle intervention programs, is needed. The development of specific recommendations regarding standardized outcome measures, based on expert consensus, would help guide investigators in designing trials, facilitate future comparisons across studies and thus aid in the systematic evaluation of evidence and establishment of informed clinical guidelines.

Limitations of this review

Limitations of this review include restriction of studies to those published in English language. We did not perform meta-analyses due to the extreme heterogeneity of existing studies. While meta-analyses can be informative when the combined studies are relatively homogeneous with respect to design, attrition, outcome measures, and interventions, they are of limited utility when included studies differ widely in these factors [106–107]. Publication bias may also have led to differential reporting of benefits, although persistent skepticism in the medical and research community regarding the therapeutic merit of mind-body practices [108] renders selective publication of positive findings less likely.

Conclusions

In short, findings from studies to date suggest that yoga-based programs, breathing practices, and certain other mind-body therapies may be beneficial for reducing vasomotor and other menopausal symptoms. However, most existing studies suffer methodological limitations that hinder interpretation of findings and preclude firm conclusions. Additional rigorous, high-quality controlled trials are needed to determine both the short and long term effects of specific mind-body therapies on menopausal symptoms, to investigate potential mediating factors and underlying mechanisms of action, and to compare these treatments with other existing therapies.

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Table 1

Studies evaluating the effects of mind-body therapies on menopausal symptoms: Trial characteristics, outcomes, and major findings

First Author, year; Location; Tx Duration	Study Population	Sample Size (Enrolled/Completed)	Mind-body Intervention	Comparison Condition	Outcomes and Assessment Times	Major Findings
<i>Yoga, Tai Chi, and Meditation-based therapies</i>						
Uncontrolled Clinical Trials						
Booth-La Force, 2007 [33]; [WA], USA; 10 weeks	Healthy peri- and postmenopausal women experiencing ≥ 4 HF/day, ≥ 4 days/wk Age: 47–59 yrs, X=52.6 Race: White (82%)	12/11	Hatha yoga Class: 75 mins * 1/wk Home: ≥ 15 mins/day Included: poses, breathing, relaxation, props	None	General menopausal sx: WMenSxCk Vasomotor sx: HF/24 hr-mon; HF diary; HFRDIS Sleep: PSQI Times: pre & post tx	WMenSxCk * (HF*, NISvt*), HFRDIS *, PSQI ** (sleep quality, sleep efficiency *)
Cohen, 2007 [34]; CA, USA; 8 weeks	Postmenopausal women experiencing moderate to severe HF's (≥ 4 /day or ≥ 30 /week) Age: X=57.6 $\pm$ 3.1 yrs; Race: White (76.9%) BMI: X=27.8 $\pm$ 4.3	14/13	Restorative yoga Class: 3 hr introductory workshop; 90 min * 1/wk Home: 1 hr * ≥ 3 x/wk Included: poses, relaxation; used props	None	General menopausal sx: MENQOL; MenSxQ Vasomotor sx: HF diary: HF/wk and HF score (freq * sev) Sleep: ISI Times: pre & post tx (HF diary at Wk 4 as well)	MENQOL (physical*), HF/wk ***, HF score ***, ISI*
Delavar, 2008 [35]; Iran; 12 weeks	Postmenopausal women Age: 44–62 yrs, X=52.37 $\pm$ 0.66 BMI: 18.25–72 kg/m ² , X=27.63 $\pm$ 1.11	47/44	Hatha Yoga-Restorative Class: 60 min * 3x/week; Included: poses, breathing, relaxation; used props	None	General menopausal sx: MenSxCk (a 20 item checklist [0–3 severity score/item], includes HF, psych, sleep, fatigue, urogenital sx, ache/pains, etc) Times: baseline, 4, 8, & 12 wks	MenSxCk total score *** (12/20 items) [incl: HF, depression, anxiety, tiredness], 18/20 items **, 19/20 items *
Carmody, 2006 [36]; MA, USA; 7 weeks	Peri- and postmenopausal women experiencing ≥ 7 moderate to severe HF's/day on most days in last month Age: 48.54–60.65, X=53.65 $\pm$ 3.66 BMI: 18.34–34.75, X=25.47	18/13 [12@F/u]	Mindfulness-Based Stress Reduction Class: Eight 150 min classes over 7 wks, plus an all-day class during weekend of the 6th wk Home: 45 min * 6 days/wk Included: body scan meditation, sitting meditation, mindful stretching exercises	None	General menopausal sx: MENQOL Vasomotor sx: Daily HF log; HFRDIS Psychological status: SCL-90R; PSS Sleep: WHIIRS Times: pre & post tx, and 1 mo F/u (11 wks)	MENQOL (total **, vms*), HF freq **, HF sev ** maintained at F/u, HFRDIS activities *, SCL-90R (global**), PSS*, WHIIRS

First Author, year; Location; Tx Duration	Study Population	Sample Size (Enrolled/Completed)	Mind-body Intervention	Comparison Condition	Outcomes and Assessment Times	Major Findings
Manocha, 2007 [37]; Australia; 8 weeks	Healthy women > 6 months amenorrheic experiencing ≥ 5HF/day, aged 40–60 years	14/10 [9@F/u]	Sahaja Yoga Meditation Class: 90 mins *2/wk Home: 15 mins *2/day Included: training to experience “mental silence” meditation	None	General menopausal sx: KI: GCS; MENQOL Vasomotor sx: Flash Count Diary Psychological status: STAI Times: pre, mid (4 wks), & post tx, and 8 wk F/u (16 wks)	KI **, GCS (vms) **, som **, anxiety **, psychometric **, MENQOL (psychosocial **, sexual **); HF freq
Non-randomized Controlled Trials						
Xu, 2004 [38]; [Australia]; 4 months	Menopausal women Age: X=49.3 yrs	[58]/40 Tx1: ?/12 Tx2: ?/14 Tx3: ?/14	Tx1: Tai Ji 1 hr *2x/wk. Included: movements to gather qi, focus mind, relax body, move qi and blood, and exercise muscles, joints, and lumbar region;	1 Acupuncture Tx: 30 min *2x/wk Included: KID-3, SP-6, ST-36, uniform reinforcing-reducing technique; 2 Herbal therapy Decoction taken 2x/day Included: Shu Di Huang and Shan Zha formula	General menopausal sx: TCM dx was used to measure changes in participants’ observable and reported menopausal sx Times: pre & post tx [Note: Menopausal Sx were secondary outcomes of this study]	Intergroup: n.r. Within group: Tai Ji: Abd distension **, tired *, HF %usirl, NiSwt Acu: LBP **, tired **, HF **, NiSwt *, insomnia **, HA **, thirst Herbal: LBP **, knees/leg/feet **, abd distension **, swollen **, tired **, palpitations **, HF **, NiSwt **, insomnia **, HA **, thirst
Randomized Controlled Trials						
Carson, 2009 [39]; NC, USA; 8 weeks	Breast cancer survivors (disease-free) experiencing ≥ 1 HF/day on ≥ 4 days/wk Age: X=54.4±7.5 yrs Race: White (81.1%), African-Amer (18.9%); Educ: College degree (70.3%); Marital: Partnered (75.7%)	37/30 Tx: 17/13; C: 20/17	Yoga of Awareness program [Kripalu] Class: 120 mins *1/week; Home: daily home practice encouraged (CD and handbook); Included: poses, breathing, meditation, study of pertinent topics; and group discussions	Wait-list control	Daily menopausal sx using 0–9 scales: General menopausal sx: joint pain, fatigue, Sx-related bother Vasomotor sx: HF freq, HF sev, HF Total score (HF freq * HF sev), NiSwt Mood: negative mood Sleep: sleep disturbance	Intergroup (Pre-post tx): HF freq **, HF sev **, HF score%usirl, joint pain **, fatigue **, Sx-related bother **, sleep disturbance **, vigor **, others, NS Intergroup (3 mo follow-up): HF freq **, HF sev **, HF Total **, joint pain **, fatigue **, Sx-related

First Author, year; Location; Tx Duration	Study Population	Sample Size (Enrolled/Completed)	Mind-body Intervention	Comparison Condition	Outcomes and Assessment Times	Major Findings
Chattha, 2008 [40–41]; India; 8 weeks	Pre-, peri-, and postmenopausal women experiencing menopausal sx, age 40–55 yrs Employment: Housewives (88%)	120/108 Tx: 59/54; C: 61/54	Yoga [Integrated Approach to Yoga Therapy] Class: 1Hr * 5 days/wk Included: poses, breathing, meditation, lectures	Exercise (nonsweating) Class: 1Hr * 5 days/wk Included: brisk walk, loosening practices, supine rest, lectures	General menopausal sx: GCS Vasomotor sx: VCL ^b (a checklist of vsm sx-HF, NiSwT, and sleep disturbances, with severity score ranging from 0–3) Psychological status: PSS; EPI Cognitive Function: SLCT ^b ; PGIMS ^b Times: pre & post tx	Intergroup: GCS (vms *** 3, psych (p=0.06), VCL (HF, p=0.08, NiSwT, p=0.06, sleep disturbed, p=0.08), SLCT%usirl, PSS *** , EPI neuroticism * SLCT *** , PGIMS (8 of 10 subgroups ** to ***) Within group: Tx: GCS *** , psych *** , som *** , VCL (HF *** , NiSwT *** sleep disturbed ***), EPI neuroticism *** C; NiSwT * GCS psych *
Elavsky, 2007 [42–43]; [PA], USA; 4 months	Pre-, peri-, or postmenopausal, sedentary or low active women (age: 42–58 yrs) experiencing vasomotor sx w/in past mo Age: X=49.9±3.6 yrs Race: White (83%) Educ: College (64%) Income: Above-avg (67%) 88% had poor sleep quality	164/123 Tx1: 62/37 Tx2: 63/50 C: 39/36	Tx1: Iyengar Yoga Class: 90 min * 2x/wk Home: asked to practice per handouts received wkly Included: poses and meditation; used props	1 Walking Class: 1 hr * 3x/wk Home: individualized exercise prescription, 15–45 min; used heart rate monitors and motivational materials to maximize fitness gains 2 Waitlist control-no tx	General menopausal sx: GCS; UQOL Psych status: AFI2; BDI; SWLS Sleep: PQSI ^b Times: pre & post tx	Intergroup: GCS: NS; UQOL * Positive Affect *; negative Affect *; BDI, n.r.; SWLS, n.r.; PSQI, NS Within group: GCS: All groups (yoga, walk, and C) show trend to improvement in total Sx: Effect size (Cohen's d) for GCS: total sx (d=0.37, 0.61, 0.30); psych sx (d=0.41, 0.68, 0.35, respectively); sexual sx tend to decrease in yoga (d=0.21), walking (d=0.33); PSQI: NS

First Author, year; Location; Tx Duration	Study Population	Sample Size (Enrolled/Completed)	Mind-body Intervention	Comparison Condition	Outcomes and Assessment Times	Major Findings
<i>Other Relaxation Therapies (all Randomized Controlled Trials)</i>						
Germaine, 1984 [44]; MI, USA 6 weeks	Healthy menopausal women reporting ≥ 2 HF's per day Age: 44-61 yrs, X = 50.3	14/14 Tx: 7/7; C: 7/7	Progressive Muscle Relaxation Class: 1 hr * 1/wk Home: 2x/day Included: training to tense and release 16, 7, then 4 ms grps (2 sessions each level)	α-EEG-biofeedback Class: 1 hr * 1/wk Home: 2x/day Included: visual feedback for the production of 8-13 Hz EEG activity	Vasomotor sx: Time latency for hot flash response to heat, HF freq Times: pre & post tx [HF diaries completed daily 1 wk before, during, and 1 wk after tx, then for 1 mo at 6 mo F/u]	Intergroup: Latency **, HF freq ** Within group: Tx: Latency **, HF freq ** (maintained at 6 mo F/u); C: NS for latency or HF freq
Nedstrand, 2005 [45]; Sweden; 12 weeks	30 healthy, sedentary women with a spontaneous menopause at least 6 months previously, experiencing moderate to severe vasomotor sx	30/28 Tx: 15/13 [12@F/u]; C: 15/15 [9@F/u]	Applied Relaxation-12 wks Class: 60 mins * 1/wk Home: $\geq$ once/day; Included: i) progressive muscle, ii) release-only, iii) cue-controlled, iv) differential, and v) rapid relaxation, vi) application training, vii) maintenance program	Estrogen-9 mos-unopposed oral estradiol for 12 wks (2 mg); then continue estrogen with progestagens added	General menopausal sx: Modified KI General climacteric sx VAS Vasomotor sx: HF/24 hr Log Psych status: SCL-90; Mood scale Times: baseline, 4, 8, & 12 wks; then 3 & 6 mo F/u [HF Logs completed daily from 2 wks before tx, during tx, then 1 wk/mo during 6 mo F/u]	Intergroup (pre-post tx): HF/24h **** [Estrogen] KI, VAS, SCL, MOOD: n.r. Within group: Both AR and Est: HF/24 hr **** at 12 wks, 3 & 6 mos; KI [†] , VAS [†] , SCL [†] at 12 wks. At 6-mo: AR & 12 wks; then 3 & 6 MOOD *, Est MOOD ****
Nedstrand, 2005 [46-47]; Sweden; 12 weeks	Breast cancer survivors, postmenopausal experiencing moderate to severe vasomotor sx, and ≥ 2 HF's/24 hr Age: 30-64 yrs, X=53	38/31 Tx: 19/14; C: 19/17	Tx1: Applied Relaxation Class: 60 mins * 1/wk Home: $\geq$ once/day; Included: i) progressive muscle, ii) release only, iii) cue-controlled, iv) differential, and v) rapid relaxation, vi) application training, vii) maintenance program	Tx2: Electro-acupuncture: Sessions: 30 min * 2x/wk * 2 wks, then 30 min * 1/wk * 10 wks	General menopausal sx: Modified KI General climacteric sx VAS ^b Vasomotor sx: HF/24 hr Log Psych status: SCL-90 ^b ; Mood scale ^b Times: baseline, 4, 8, & 12 wks; then 3 & 6 mo F/u [HF Logs completed daily from two weeks before tx, during tx, then 1 wk/mo during 6 mo F/u]	Intergroup: HF/24 hr, n.r.; KI, VAS, SCL, Mood, all NS Within group: Both AR and EA: KI **** and HF/24 hr **** at 4 wks, 12 wks, and 6 mos. VAS **** and SCL ****; Mood * for EA only
Freedman, 1992 [48];	Healthy postmenopausal (≥ 1	33/? Tx1: 11/?;	Tx1-Paced Respiration Training: 1 hr * 2/wk	α-wave biofeedback (Placebo Control)	Vasomotor sx: HF Freq using 24-hr	Intergroup: HF/24 hr-mon *

First Author, year; Location; Tx Duration	Study Population	Sample Size (Enrolled/Completed)	Mind-body Intervention	Comparison Condition	Outcomes and Assessment Times	Major Findings
[M], USA; 4 weeks	yr amenorrheic women experiencing ≥ 5 HF ² s/day Race: White (64%)	Tx2: 11/?; C: 11/?	Included: training to breathe at 6–8 cycles/min and to increase abdominal respiration volume Tx2-Muscle Relaxation Training: 1 hr *2/wk Included: training to tense and release 16, 7, then 4 ms grps (2 sessions each level)	Training: 1 hr *2/wk Included: visual feedback for the production of 8–13 Hz EEG activity	ambulatory monitoring of sternal skin conductance level Times: pre & post tx	Within group: Tx1: HF/24 hr-mon * Tx2: NS C; NS
Freedman, 1995 [49]; [M], USA; 4 weeks	Healthy postmenopausal (≥ 1 yr amenorrheic) women experiencing ≥ 5 HF ² s/day -Race: White (66.67%) African-American (33.33%)	24/? Tx: 13/?; C: 11/?	Paced Respiration Training: 1 hr *2x/wk Home practice: 15 min *2x/day and at onset of an HF or in situations likely to trigger HF (e.g., warm room) Included: training to breathe at 6–8 cycles/min and to increase abdominal respiration volume	α-wave biofeedback (Placebo Control) Training: 1 hr *2x/wk Included: visual feedback for the production of 8–13 Hz EEG activity	Vasomotor Sx: HF Freq using 24-hr ambulatory monitoring of sternal skin conductance level Times: pre & post tx	Intergroup: HF freq, n.r. Within group Tx: HF freq C: NS
Fenlon, 1999 [50]; UK; 1 month	Women treated for breast cancer and suffering from hot flushes Age: 29–74 yr, X=49 Race: White (100%)	24/16 Tx: ?/8 C: ?/8	Relaxation Class: 2 individual training sessions, one week apart Home: * Daily Included: deep breathing and guided imagery	Wait-list Control (No tx)	Vasomotor Sx: HF/day, NISwt/night, 10 cm VAS (HF & NISwt: distress, problem factor, interference to normal life) Psych status: GHQ Assessment times: pre & post tx	Intergroup: GHQ *; other measures, NS [HFdistress=0.09] Within group Tx: GHQ C: GHQ, NS
Fenlon, 2008 [51]; UK; 1 month (minimum)	Women with primary breast cancer, 6 mos amenorrheic, suffering HF ² s Age: 36–77 yrs Race: White (93%) Marital: Partnered (72%)	150/104 [97@F/u] Tx: 76/50 [46@F/u]; C: 74/54 [51@F/u]	Relaxation Training: One, 60-minute, one to one training session, then used tape for daily practice Home: 20 min * 1/day Included: Deep breathing, muscle relaxation, and guided imagery	Attention Control (no tx) Included: Spending time with a specialist nurse discussing hot flashes and menopause management	Vasomotor Sx: HF diary (freq and sev); HMS (distress, problem, interference to daily life) Psych Status: STAI Other: FACT-ES Times: pre & post tx, and 2-mo F/u (3 mos)	Intergroup at 1 mo: HF/wk *** , HF sev * , and HF distress * , other measures NS [HF problem (p=0.06), HF interference to daily life (p=0.09)] Intergroup at 3 mo: all NS [HF/wk (p=0.06), HF sev (p=0.05)] NOTE: Study set alpha at 0.01 due to large number of tests
Irvin, 1996 [52]; MA, USA; 7 weeks	Healthy postmenopausal (≥ 6 mo amenorrheic) women experiencing ≥ 5 HF ² s/24 hrs Age: 44–66 yrs	45/33 Tx: ?/11; C1: ?/11; C2: ?/11	Relaxation Response Training: One, 1-hr session with the investigator; then audio tape used for home practice Home: ≥ 20 min * 1/day	Control 1-Reading (Placebo) Training: one session on reading technique Home: 20 min * 1/day Included: leisure reading;	Vasomotor Sx: HF Log (freq and intensity) Psych Status: STAI; POMS Times: pre & post tx	Intergroup: n.r. Within group Tx: HF sev * , tension-anxiety * , depression-dejection * ; others, NS;

First Author, year; Location; Tx Duration	Study Population	Sample Size (Enrolled/Completed)	Mind-body Intervention	Comparison Condition	Outcomes and Assessment Times	Major Findings
Rankin, 1989 [53]; [NJ], USA; 2 weeks	Healthy menopausal women experiencing menopausal sx Age: 40–58 yrs, X=49.3 Race: White (96%) Educ: College degree (67%)	40/27 Tx: 20/14; C: 20/13	Included: Elicitation of the Relaxation Response using breath as mental focus and passive mental attitude toward distractions Low frequency sound wave therapy Home: 20 mins *3x/week Included: listening to audiotape by Halpern of low freq sound waves designed to promote a sense of well being and muscle relaxation	Control 2-Wait-list (No tx) Usual Care Control (No tx)	(Note: Baseline HF levels measured for 1st 3 wks, then tx instruction was given) General menopausal sx: MIS Times: pre & post tx	C1-Reading: confusion-bewilderment * , trait anxiety * ; others, NS; C2-No tx: all NS Intergroup: MIS (sx freq * , som * , psych *), number of sx (p=0.075)

Abbreviations: Acu=Acupuncture; Aff2=Affectometer 2; AR=Applied Relaxation; BDI=Beck Depression Inventory; C=Control; EA=Electro-Acupuncture; EPI=Eysenck's Personality Inventory; Est=Estrogen; FACT-ES=Functional Assessment of Cancer Therapy with the Endocrine Sub-scale; freq=frequency; F/u=Follow up; GCS=Greene Climacteric Scale; GHQ=General Health Questionnaire; HF=Hot flash; HF/24 hr-mon=24 hr ambulatory monitoring of sternal skin conductance level; HFRDIS=Hot Flash-Related Daily Interference Scale; HMS=Hunter Menopausal Symptom Questionnaire; Index: KI=Kupperman's Index; LBP=Low Back Pain; MENQOL=Menopause specific Quality of Life; MenSxQ=Menopausal Symptom Checklist; MenSxQ=Menopausal Symptom Questionnaire; MIS=Newgarden-Kraines Menopausal Index Scale; MR=Muscle relaxation; n.r.=Not Reported; NS=Not Significant; NISwt=Night Sweats; PGIMS=Punit Govil Intelligence Memory Scale; POMS=Profile of Mood States; PR=Paced Respiration; PSQI=Pittsburgh Sleep Quality Index; PSS= Perceived Stress Scale; Psych=Psychological; R=Reading group; RR=Relaxation response; SCL-90=Symptom Checklist-90; SCL-90-R=Hopkins Symptom Checklist; sev=severity; SLCT=Six Letter Cancellation Test; Som=Somatic; STAI=State Trait Anxiety Inventory; SWLS=Satisfaction with Life Scale; Tx=Treatment/Intervention; UQOL=Utian Quality of Life Scale; VAS=Visual Analog Scale; VCL=Vasomotor CheckList; VMS=VasoMotor Symptoms; WHIIRS=Women's Health Initiative Insomnia Rating Scale; WMenSxQ=Wiklund Menopause Symptom Checklist.

* p ≤ 0.05;
 ** p ≤ 0.01;
 *** p ≤ 0.001;
 † 95% CI: Tx group improved unless noted otherwise;
 b Outcome reported in another publication

Table 2

Observed percent change in overall menopausal and vasomotor symptoms by treatment group

Endpoint	Study: First author, year	Treatment Group	% Change post-intervention		% Change at follow-up	
			UCT	RCT	UCT	RCT
Menopausal Symptoms Overall						
Kupperman index	Manocha, 2007 [37]	Yogic meditation	58.2%		40.4%	
	Nedstrand, 2005 [46]	Applied relaxation		46.0%		47.6%
		Electroacupuncture		39.4%		40.7%
	Nedstrand, 2005 [45]	Applied relaxation		37.4%		41.9%
		HRT		72.27%		76.5%
Visual Analog Scale	Nedstrand, 2005 [46]	Applied relaxation		46.15%		47.7%
		Electroacupuncture		45.6%		45.6%
	Nedstrand, 2005 [45]	Applied relaxation		50.0%		57.8%
		HRT		72.7%		72.7%
					21.4%	
Greene Climacteric Scale						
Psychosocial	Manocha, 2007 [37]	Yogic meditation	74.3%			
	Chattha, 2008 [41]	Yoga		40.9%		
		Exercise		12.5%		
	Elavsky, 2007 [43]	Yoga		24.6%		
		Walking		33.8%		
Somatic		Wait list control		18.6%		
	Manocha, 2007 [37]	Yogic meditation	80.3%		29.3%	
	Chattha, 2008 [41]	Yoga		37.4%		
		Exercise		28.2%		
	Elavsky, 2007 [43]	Yoga		9.2%		
Vasomotor		Walking		26.5%		
		Wait list control		10.4%		
	Manocha, 2007 [37]	Yogic meditation	71.1%		52.4%	
	Chattha, 2008 [41]	Yoga		36.4%		
		Exercise		9.7%		
	Elavsky, 2007 [43]	Yoga		16.1%		
		Walking		17.5%		

Endpoint	Study: First author, year	Treatment Group	% Change post-intervention		% Change at follow-up	
			UCT	RCT	UCT	RCT
Sexual	Elavsky, 2007 [43]	Wait list control		5.8%		
		Yoga		19.6%		
		Walking		29.3%		
		Wait list control		5.4%		
Wiklund Symptoms Checklist	Booth-LaForce, 2007 [33]	Yoga	35.7%			
Menopause-Related Quality of Life Questionnaire (MENQOL)						
Vasomotor	Manocha, 2007 [37]	Yogic meditation	46.7%		46.7%	
	Cohen, 2007 [34]	Yoga	26.2%			
	Carmody, 2006 [36]	MBSR	26.2%			
	Manocha, 2007 [37]	Yogic meditation	53.0%		31.7%	
	Cohen, 2007 [34]	Yoga	24.4%			
Physical	Carmody, 2006 [36]	MBSR	17.8%			
	Manocha, 2007 [37]	Yogic meditation	45.9%		37.2%	
Psychosocial	Cohen, 2007 [34]	Yoga	25.0%			
	Carmody, 2006 [36]	MBSR	32.5%			
Sexual	Manocha, 2007 [37]	Yogic meditation	56.2%		33.3%	
	Cohen, 2007 [34]	Yoga	18.2%			
	Carmody, 2006 [36]	MBSR	38.7%			
Menopausal Index Scale						
Number of symptoms	Rankin, 1989 [53]	Audiotape (low frequency sound)		8.5%		
Frequency of symptoms	Rankin, 1989 [53]	Usual care		-5.2%		
		Audiotape		48.0%		
Somatic symptoms	Rankin, 1989 [53]	Usual care		-28.6%		
		Audiotape		52.9%		
Psychological symptoms	Rankin, 1989 [53]	Usual care		-52.9%		
		Audiotape		47.7%		
Psychosomatic symptoms	Rankin, 1989 [53]	Usual care		-41.7%		
Vasomotor symptoms		Audiotape		43.5%		
Daily hot flash log/Flash count diary	Manocha, 2007 [37]	Yogic meditation	67.2%		56.2%	

Endpoint	Study: First author, year	Treatment Group	% Change post-intervention		% Change at follow-up	
			UCT	RCT	UCT	RCT
Hot Flush Severity Score	Carson, 2009 [39]	Yoga		16.0%		28.2%
		Wait list control		-2.6%		-3.0%
	Cohen, 2007 [34]	Restorative yoga	26.6%			
		Yoga	34.3%		39.4%	
	Carmody, 2006 [36]	Applied relaxation		51.1%		57.6%
		Electroacupuncture		51.2%		58.3%
	Nedstrand, 2005 [46]	Applied relaxation		50.0%		71.7%
		HRT		90.4%		90.4%
	Fenlon, 2008 [51]	Musc. Relaxation+ breathing, imagery		22.2%		34.9%
		Attention control		2.7%		10.8%
	Fenlon, 1999 [50]	Breathing+imagery		25.0%		
		Usual care		-10.0%		
	Irvin, 1996 [52]	Relaxation response		21.9%		
		Reading		36.3%		
	Freedman, 1992 [48]	No treatment control		9.0%		
		Paced Respiration		38.9%		
Subjects reporting hot flashes	Freedman, 1995 [49]	Muscle Relaxation		4.2%		
		α -Wave		-16.5%		
	Germaine, 1984 [44]	Biofeedback		42.1%		
		Paced Respiration		42.1%		
		α -Wave				
		Biofeedback		3.3%		
		Muscle Relaxation		54.5%		
		α -Wave				
	Delavar, 2008[35]	Biofeedback		-18.6%		
		Yoga	48.8%			
Subjects reporting hot flashes	Carson, 2009 [39]	Yoga		22.8%		
		Wait list control		5.6%		
	Carmody, 2006 [36]	MBSR	40.6%			
		Tai Chi	50.0%		40.6%	

End point	Study: First author, year	Treatment Group	% Change post-intervention		% Change at follow-up	
			UCT	RCT	UCT	RCT
Subjects reporting night sweats	Xu, 2004 [38]	Acupuncture	35.7%			
		Herbal therapy	57.1%			
		Tai Chi	41.7%			
		Acupuncture	71.4%			
Vasomotor symptom checklist	Chattha, 2008 [40]	Herbal therapy	21.4%			
		Yoga		51.0%		
		Exercise		10.3%		
		Yoga		48.2%		
night sweats	Chattha, 2008 [40]	Exercise		23.5%		
		Yoga		40.5%		
		Exercise		12.9%		
		Yoga				
disturbed sleep	Chattha, 2008 [40]	Exercise				
		Yoga				
		Exercise				
		Yoga				
Hot Flash related daily Interference Scale	Booth-LaForce, 2007 [33]	Yoga	60.0%			
		Yoga				
		Exercise				
		Yoga				
Symptom related bother	Carmody, 2006 [36]	MBSR				
		Yoga	33.3%			
		Yoga		36.4%		38.3%
		Wait list control		2.8%		2.8%

† Non-randomized controlled trial, % represents average reduction in total symptoms
Abbreviations: HRT=Hormone replacement therapy; musc=muscle; MBSR=Mindfulness-based stress reduction