Effects of Yoga on Stress Among Healthy Adults: A Systematic Review

Feifei Wang, MSc; Attila Szabo, PhD, DSc

ABSTRACT

Background • Yoga was recommended in both clinical and nonclinical populations as therapy methods. The diversity of yoga practice as a therapy method has rarely been discussed and it is essential to address the effects of yoga on stress.

Primary Study Objective • This article aims to investigate the effect of different types of yoga on stress in healthy population. On the other hand, the authors intended to figure out yoga effects on stress systematically.

Methods/Design • A systematic literature review was conducted to identify articles that assess the effect of yoga and yoga-related interventions on stress reduction in nonclinical populations. Studies were classified according to the length of the intervention, yoga type, and measures of outcome. The studies were selected throughout last 5 years (January 2014 to November 2018) by using the key searching term yoga and stress incorporation with tension and pressure. The selection process followed the Prisma flow diagram.

Results • Totally, 12 articles elaborating on the effects of yoga or yoga-related interventions on stress management and remission were included in the review. This review included various types of yoga practice (e.g., Hatha yoga, Bikram yoga, Kundalini yoga, Sudarshan Kriya yoga, Kripalu yoga, Yin yoga). A time spectrum was conducted from 4 wks to 28 wks. This review revealed that most types of yoga have positive effects on stress reduction in healthy populations.

Conclusion • Further studies are recommended to examine the long-term effect of yoga and underlying psychological mechanisms causing stress and mental restrain. In addition, it is suggested to consider age as a risk factor affecting the effect of yoga on stress. (Altern Ther Health Med. 2020;26(4):58-64).

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INTRODUCTION

Yoga has become popular as a therapeutic and relaxation intervention among all age groups, including the older adults. Although there are many types and styles of yoga, typical yoga practices combine stretching and holding various poses (called asanas) with deep, rhythmmed breathing and meditation, with the goal of increasing physical flexibility and strength in skeletons.1 A treasury of 112 types of yoga written by Singh explicitly answered the context of yoga types, by which the highest reality was reached.2 Nevertheless, despite the wide variety of yoga, its implementation was successful worldwide in scientific research.

The effects of yoga on health have been illustrated many times. Studies have shown that yoga benefits health both in clinical patients and nonclinical populations. Yoga as a treatment for insomnia among patients with cancer and survivors was systematically reviewed and suggested promising evidence of yoga for its efficacy in improving insomnia and sleep quality impairment.3 Evidence showed psychophysiological effects of yoga, and it was suggested to increase endogenous secretion of melatonin, which, in turn, might be responsible for improving the sense of well-being.4 In addition, meditation also showed physiological effect by
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**Methods**

To examine our hypothesis, we conducted a systematic review. The PICO standard was used as a supportive guideline in the study selection. Before assessing by PICO, all manuscripts initially considered relevant by title and abstract were eligible for inclusion. Details in PICO standard:

- **P** (population): Regular healthy participants (not hospitalized patients or with clinical diseases, not pregnant ladies, not in day-night shifting works).
- **I** (intervention/exposure): Organizing yoga-based intervention.
- **C** (comparison): Studies comparing healthy adults conducting yoga practice versus healthy adults not conduction yoga practice, where such comparison has been performed;
- **O** (outcome): Effects of yoga practice on stress.

**Inclusion and Exclusion Criteria**

The source of stress differs in adults regarding to the life management and social engagement. We accepted only studies conducted within adults (18 years and older in this study). Trials were excluded if any participants who were clinical patients with physical or mental symptoms, shift working personnel, or people with sleep disorder or perinatal women. The reason why we excluded shift-working personnel was that shift workers may suffer extra stress compared with the healthy population with regular life routine. Pregnant women who have to go to hospital for regular medical check was excluded due to their special body condition. People who undergo sub-health condition (eg, people with sleep disorders, insomnia) were also excluded because stress may interact with subhealth conditions.

Studies which conducted with multiple or mixed research methods were excluded. In addition, we also excluded publication of reviews articles and letter to editors in this study. If multiple published reports from the same trial were available, only the report that contain the most qualified information were taken into consideration. Nevertheless, we did not take the sample size as an exclusion criterion. Meanwhile, reviews or longitudinal studies were not included. The inclusion and exclusion criteria are presented in Table 1.

**Quality Assessment**

We used the Critical Appraisal Skills Programme (2018) checklist to assess the quality of the selected studies. These checklists were designed to be used as educational pedagogic tools, as part of a workshop setting, therefore we do not suggest a scoring system. The core

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**Table 1. Inclusion and exclusion criteria used when selecting articles in the systematic review**

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>People above 18 years old</td>
</tr>
<tr>
<td>People with clinical symptoms (physical or mental disorder, or undergoing regular medical check) or in shift-work schedule</td>
<td></td>
</tr>
<tr>
<td>Intervention/exposure</td>
<td>Yoga based study on stress</td>
</tr>
<tr>
<td>Empirical or observational Original studies</td>
<td>Review (systematic review; meta-analysis)</td>
</tr>
<tr>
<td>Contain intervention and controlled groups</td>
<td>Case-control studies</td>
</tr>
<tr>
<td>Outcome</td>
<td>Outcome elaborated the effect of yoga on stress</td>
</tr>
<tr>
<td>Timeframe from January 2014 to November 2018</td>
<td>Questionable analysis methods.</td>
</tr>
<tr>
<td>Non-English study</td>
<td></td>
</tr>
</tbody>
</table>

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increasing cardiac output, which inherently influence basal metabolic rate. As to cognitive function, yoga practice showed no significant improvement in healthy population; however, yoga practice disclosed inspiring results in quality of life and physical measures. Nevertheless, yoga-based intervention program is feasible and efficacious in creating positive improvements of health and wellness.

The psychological effect of yoga has been examined in previous study. Yoga appears to work on depression, anxiety, and self-efficacy. For instance, a systematic review carried out in 2004 investigated the effectiveness of yoga on the treatment of anxiety and anxiety disorders. Evidence reported encouraging results with obsessive compulsive disorder despite the diversity of intervention conditions and deficient quality of the studies.

Demonstrated by a recent review that involved 27 studies, of which 19 studies reported significant reduction in state and/or trait anxiety. In women who suffer from anxiety disorders, 2-month yoga class can lead to significant reduction in perceived levels of anxiety.

The effect of yoga and stress has been examined in wide range of age groups and social status including prisoner and office set. The mechanism of yoga and stress has been underlined. Positive affect, self-compassion, inhibition of the posterior hypothalamus and salivary cortisol from a current systematic review were all shown to mediate the relationship between yoga and stress. Due to the diversity of yoga practices and the vulnerable evidence existed in yoga types and stress in healthy populations, the present study sought to better characterize the benefits of yoga on stress. This systematic review evaluates the current scientific evidence of yoga practice on stress. We hypothesize that any types of yoga will have beneficial effects on stress. We examined this question across a large age range.
Wang—Yoga and Stress Among Healthy Adults

Table 2. Assessment of Risk of Bias

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hewett et al(^2) (2018)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Low</td>
</tr>
<tr>
<td>Hylander et al(^3) (2017)</td>
<td>yes</td>
<td>unclear</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Marques et al(^4) (2017)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Low</td>
</tr>
<tr>
<td>Maddux et al(^5) (2017)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Low</td>
</tr>
<tr>
<td>Park et al(^6) (2017)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Low</td>
</tr>
<tr>
<td>Chandra et al(^7) (2017)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>unclear</td>
<td>no</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Garcia-Sesnich et al(^8) (2017)</td>
<td>unclear</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Hunt et al(^9) (2017)</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>High</td>
</tr>
<tr>
<td>Peterson et al(^10) (2017)</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>unclear</td>
<td>High</td>
</tr>
<tr>
<td>Harkess et al(^11) (2016)</td>
<td>yes</td>
<td>yes</td>
<td>unclear</td>
<td>yes</td>
<td>yes</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Lindahl et al(^12) (2016)</td>
<td>yes</td>
<td>yes</td>
<td>unclear</td>
<td>no</td>
<td>no</td>
<td>High</td>
</tr>
<tr>
<td>Bilderbeck et al(^13) (2015)</td>
<td>unclear</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>unclear</td>
<td>High</td>
</tr>
</tbody>
</table>

Note: “Low” indicates low risk of bias; “High” indicates high risk of bias; “Uncertain” indicates the risk of bias is uncertain.

CASP checklists were based on JAMA 'Users' guides to the medical literature adapted from Guyatt et al., which piloted with health care practitioners. The checklist was adopted when rating the selected studies, we did not make comments on the studies. All items are rated as "yes," "no," or "can't tell," and Figure 1 summarizes the items by the checklist.

Bias Assessment

Publication bias always need to be taken into consideration in systematic review. However, up to now, there is no exact tool to assess the publication bias. With the comprehensive search strategy, we relied on the tool for risk of bias assessment produced by Cochrane to explore the potential effects of publication bias on our results. There are 2 dimensions concerning the validity of the study to assess whether the study is asking appropriate research question (external validity), and whether it answers its research question "correctly" (internal validity). The Cochrane tool of risk of bias examined all of the included studies from 5 domains:

1. Was the allocation sequence adequately generated?
2. Was allocation adequately concealed?
3. Was knowledge of the allocated intervention adequately prevented during the study?
4. Were incomplete outcome data adequately addressed?
5. Are reports of the study free of suggestion of selective outcome reporting, and each of questions was given 3 answers: yes, no or unclear. Higgins suggested that if a trial address all the 5 domains with "yes," the trial will be considered to have "low overall risk of bias"; however, in cases in which even one of those 5 domains get an “unclear” or "no" assignment, the trial will be considered to have an “unclear or high overall risk of bias.” The details risk of bias assessment is listed in Table 2.
RESULTS
Study Selection Flow

Database searching using the method described led to the retrieval of 1469 studies (PubMed: 732, Scopus: 737). An additional source (International Journal of Yoga) online Web site was checked. All of the studies were filtered step by step. From title and abstract, it is feasible to spotted out the ineligible participants (eg, clinical patients, people under regular medical check) and research methods (eg, reviews, protocols). After screening titile and abstract, 75 articles went through full-text examination. The articles were examined by the aforementioned exclusion criteria. Finally, 12 studies were included in the system review. The flow chart of study selection process was showed in Figure 2.

Characteristics of Included Studies

The 12 studies involved 672 participants. The details of involved articles are presented in Table 3. Based on the eligibility criteria, studies with both case and control group comparison were included. Different intervention methods were performed in various ages groups in adults. Various types of yoga practice (eg, Hatha yoga, Bikram yoga, Kundalini yoga, Sudarshan Kriya yoga, Kripalu yoga, Yin yoga) with 3 spectrum from 4 weeks to 28 weeks were conducted. Single studies were published in 2015 and 2018, 2 studies were published in 2016, and the rest of the included studies were published in 2017. All of the studies organized case group and control group and measured the participants pre-post intervention. Participants were distributed...
randomized or nonrandomized. Stress was measured by perceived stress scale (PSS) in all of the studies. Studies either use 4-item or 10-item of PSS. Additional scales such as Beck Depression Inventory (BDI), Depression, Anxiety and Stress Scale (DASS-21), and Kessler Psychological Distress Scale (K10) were used in these studies.

**Effects of Yoga on Stress**

Greater improvement (or decrease) in perceived stress showed significant relation to greater yoga class attendance. Despite the duration, length, frequency, and types of yoga practice conducted in difference trials, positive results of yoga were found. Baseline and postintervention characteristics were measured of the 8 participants who completed Hatha yoga intervention, and perceived stress levels assessed by the PSS significantly decreased after the intervention (preintervention, 13.6 ± 1.2 versus postintervention, 8.9 ± 1.2), with a large effect size of 1.38. A 16-week Bikram yoga program conducted randomized control study also revealed a significant decrease in perceived stress ($P = .001$, $\eta^2_p = 0.173$, 4.7 [95% CI: 2.1, 7.4]) at end of intervention in the experimental versus the control group. Sudarshan Kriya Yoga (SKY) including Sudarshan kriya, Bhastrika pranayama, and Yoga nidra, is believed to be a powerful rhythmic breathing technique, and proved to be a more positive alternative of "medication" for stress management in previous study. The association between age and yoga effect was under investigation. Stress management interventions were highly regarded by first-year college students and demonstrated dominant effects by Park et al. The yoga-based intervention consisted of Kripalu yoga (a form of hatha yoga) was reported as being helpful in school and at home. Power yoga was organized in males ($n = 43$, age: 45.5 years) and females ($n = 43$, age: 47.1 [10.0]), and after 16 weeks intervention, the PSS scores dropped significantly. Nevertheless, the included articles showed clues of the interaction between age and the function of yoga practice. A group of older women (age: 83.16 ± 7.4 years) participated chair-based yoga, consisted of an exercise class intervention which based on the essential philosophy of Hatha yoga and its asanas, presented differences with a large effect size ($P = .052$, $d = .85$) in the exercise group (age: 83.73 ± 6.86 years) and control group (age: 82.73 ± 8.46 years). In addition, the examination of Kundalini Yoga (KY) after 3 months of regular practice presented statistical significance of perceived stress score compared with control group in the basal measurement.

The 3-day retreat program, named *Shambhavi Mahamudra kriya*, is a yogic practice that includes both deep breathing and meditation techniques suggested that may represent a natural treatment for stress reduction. However, it is suggested to take long-term effect of yoga intervention into consideration. Harkess yielded that short-term yoga

### Table 3. The details of selected studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Intervention method</th>
<th>Duration</th>
<th>Study design</th>
<th>Outcome</th>
<th>Measurements of assessing stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hewett et al (2018)</td>
<td>63 Adults (37.2 ± 10.8 y)</td>
<td>Bikram yoga</td>
<td>16 weeks</td>
<td>A randomized controlled trial</td>
<td>P.E.</td>
<td>10-item Perceived Stress Scale (PSS)</td>
</tr>
<tr>
<td>Hylander et al (2017)</td>
<td>49 middle-aged participants</td>
<td>Yin yoga</td>
<td>5 weeks</td>
<td>A case-control study</td>
<td>P.E.</td>
<td>4-item Perceived Stress Scale (PSS)</td>
</tr>
<tr>
<td>Marques et al (2017)</td>
<td>34 women (83.16 ± 7.4 y)</td>
<td>Chair-based Yoga</td>
<td>28 weeks</td>
<td>Case-control study</td>
<td>P.E.</td>
<td>Perceived Stress Scale (PSS)</td>
</tr>
<tr>
<td>Maddux et al (2017)</td>
<td>80 students (mean age 46 y)</td>
<td>Power yoga</td>
<td>16 weeks</td>
<td>Pre-post intervention</td>
<td>P.E.</td>
<td>10-item Perceived Stress Scale (PSS)</td>
</tr>
<tr>
<td>Park et al (2017)</td>
<td>51 first-year undergraduates</td>
<td>Kripalu yoga</td>
<td>8 weeks</td>
<td>A randomized controlled trial</td>
<td>P.E.</td>
<td>21-item Depression, Anxiety and Stress Scale (DASS-21)</td>
</tr>
<tr>
<td>Chandra et al (2017)</td>
<td>20 humans aged 21- to 30-y-old</td>
<td>Sudarshan Kriya yoga</td>
<td>30 days</td>
<td>Case-control study</td>
<td>P.E.</td>
<td>Stress Determination Test (SDT)</td>
</tr>
<tr>
<td>Garcia-Sesnich et al (2017)</td>
<td>26 people aged 18- to 45-y-old</td>
<td>Kundalini Yoga</td>
<td>3 months</td>
<td>Case-control study</td>
<td>P.E.</td>
<td>Perceived Stress Scale (PSS) (Spanish version)</td>
</tr>
<tr>
<td>Hunt et al (2017)</td>
<td>60 undergraduate students</td>
<td>Mindfulness training; Yoga alone</td>
<td>4 weeks</td>
<td>Case-control study Pre-post intervention</td>
<td>P.E.</td>
<td>Beck Depression Inventory (BDI) Spielberger State/ Trait Anxiety Inventory</td>
</tr>
<tr>
<td>Peterson et al (2017)</td>
<td>142 individuals (43 ± 13.90 y)</td>
<td>Multicomponent Breath-Based Yoga</td>
<td>6 weeks</td>
<td>Pre-post intervention</td>
<td>P.E.</td>
<td>10-item Perceived Stress Scale (PSS)</td>
</tr>
<tr>
<td>Harkess et al (2016)</td>
<td>84 middle-aged women</td>
<td>Yoga class</td>
<td>2 months</td>
<td>A case-control trial</td>
<td>P.E.</td>
<td>Kessler Psychological Distress Scale (K10); Perceived Stress Scale (PSS)</td>
</tr>
<tr>
<td>Lindahl et al (2016)</td>
<td>8 participants (66.5 ± 0.3 y)</td>
<td>60-min Hatha yoga sessions</td>
<td>7 weeks</td>
<td>Pre-post intervention</td>
<td>P.E.</td>
<td>Perceived Stress Scale (PSS)</td>
</tr>
<tr>
<td>Bilderbeck et al (2015)</td>
<td>55 participants (prisoners)</td>
<td>Yoga course</td>
<td>10 weeks</td>
<td>Pre-post intervention</td>
<td>P.E.</td>
<td>Perceived Stress Scale (PSS)</td>
</tr>
</tbody>
</table>

Note: P.E. = Positive Effect; N.E. = Negative Effect; N/L = No effect or Lack of evidence
practice may yield some benefits to stressed individuals, but the long-term evaluation is required to determine the optimal dose for improvements and maintenance.29 In the study, women (n = 116) between the ages of 35 and 65 years were allocated to a twice-weekly, hour-long yoga class for a period of 2 months, or into a waitlist control. Following the statistical methods of mixed-model analyses of variances and quadratic time (Time 2) included for PSS examination, the study showed that stress level did not improve significantly.29

The effectiveness of yoga and mindfulness practice on stress need to be clarified. There are differences and interactions between yoga and mindfulness. Both meditation and yoga are implementations of mindfulness therapy.30 The YOMI program, a psychoeducational training program that bridges psychological theory and knowledge with the practice of mindfulness and yin yoga, contributed significantly to decreased levels of perceived stress increased levels of mindfulness to participants.31 Hunt et al32 conducted a multigroup study with 4 groups (“Mindfulness Training Alone”; “Yoga Alone”; “Multicomponent Mindfulness Training groups”; “Study Break with a Therapy Dog”) dismantled yoga and explicated mindfulness training in a brief stress reduction intervention in college students.32 It is suggested that the “mindfulness training alone group” experienced the least stress challenge compared with combined group and yoga alone group.

DISCUSSION

The evidence of positive effect of yoga on stress management becomes apparent. All types of yoga and yoga-based interventions (eg, mindfulness-based yoga, meditation-based yoga) illustrated significant benefit to stress release. The influences of yoga on stress have been studied from a wide spectrum. The diversity of yoga practice and in conjunction with mindfulness intervention are suggested to help stress reduction and management. Yoga has a long history and recognized as a form of mind-body medicine. The physical postures and breathing exercises improve the stress outcomes such as physical and mental tension.33 This can be a strong explanation for the mechanism of yoga on stress. A systematic review supported the finding that yoga has positive effect on stress reduction in healthy adult populations.34

Further studies to ascertain yoga’s long-term effects was suggested by Chong et al.24 In our study, we found that the interventions duration seems to be an essential factor of yoga effectiveness. Studies with longer intervention period produced convincing results. Even though short-term intervention also showed beneficial result toward stress. However, the beneficial effects of short term yoga may not translate into long term effects as well.35

Aging is associated with a decline in physical function, which is the combination of a loss of muscle mass and reduced muscle function.36 Eight studies in this review conducted with middle aged and older adult participants. It was indicated that Yoga practice showed modifiable effects on baroreflex in elder population.37 Thus, yoga practice with physical movement and gestures should be taken into consideration before conducting among older adults.

Limitations

Limitations exist in this review. Methodological problems appeared in most of the selected studies including sample size limitation, short intervention period, and other factors. As mentioned previously, we did not take small sample size as an exclusion criterion, but a small sample may bias the validity of the study. In addition, the effect size of the included studies was not considered in the statistical analysis.

CONCLUSION

Though the association of exercise and age by previous study showing that many critical questions remain regarding the relationship of aging and exercise, the positive effects of yoga were highly regarded. Both cognitive behavior therapy and yoga are promising stress management techniques.38 Given that yoga and cognitive behavior therapy (CBT) have not been indicated any difference in coping with stress, it is suggested to explore the deeper function of yoga and CBT in neurology level. Due the various subcategories of yoga, a comprehensive knowledge of yoga is recommended.

Moreover, physical activity has many well-established health benefits, and physiological benefits of yoga help people become more resilient to stressful conditions, but strenuous exercise increases muscle oxygen flux and elicits intracellular events that can lead to increased oxidative injury.39 Nevertheless, more studies should be conducted to underlay biological mechanisms leading to its stress reduction effect in healthy populations.

AUTHOR DISCLOSURE STATEMENT

The authors declare that there is no conflict of interests regarding the publication of this paper. Feifei Wang conceived, designed and wrote the paper; Attila Szabo improved the approach of the systematic review and revised the final version of the paper. Both authors read and approved the final version of the manuscript. There is no interest conflict to disclose.

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