

REVIEW ARTICLE

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).

Feifei Wang, MSc, is PhD student in Education at the Institute of Sports and Health Promotion, ELTE Eötvös Loránd University, in Budapest, Hungary. Attila Szabo, PhD, DSc, is Doctor of the Hungarian Academy of Sciences, Professor of Psychology, Institute of Psychology, and Institute of Health Promotion and Sport Sciences, ELTE Eötvös Loránd University, in Budapest, Hungary.

Corresponding author: Feifei Wang, MSc

E-mail address: feifei.wang@ppk.elte.hu

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, rhythmized 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

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

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

increasing cardiac output, which inherently influence basal metabolic rate.⁵ 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.⁶ Nevertheless, yoga-based intervention program is feasible and efficacious in creating positive improvements of health and wellness.⁷

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.⁸ Demonstrated by a recent review that involved 27 studies, of which 19 studies reported significant reduction in state and/or trait anxiety.⁹ In women who suffer from anxiety disorders, 2-month yoga class can lead to significant reduction in perceived levels of anxiety.¹⁰

The effect of yoga and stress has been examined in wide range of age groups and social status including prisoner and office set.^{11,12} 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.¹³ 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.

METHODS

To examine our hypothesis, we conducted a systematic review.

Databases and Search Terms

The PICO standard¹⁵ 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 conducting yoga practice, where such comparison has been performed;

O (outcome): Effects of yoga practice on stress.

Inclusion and Exclusion Criteria

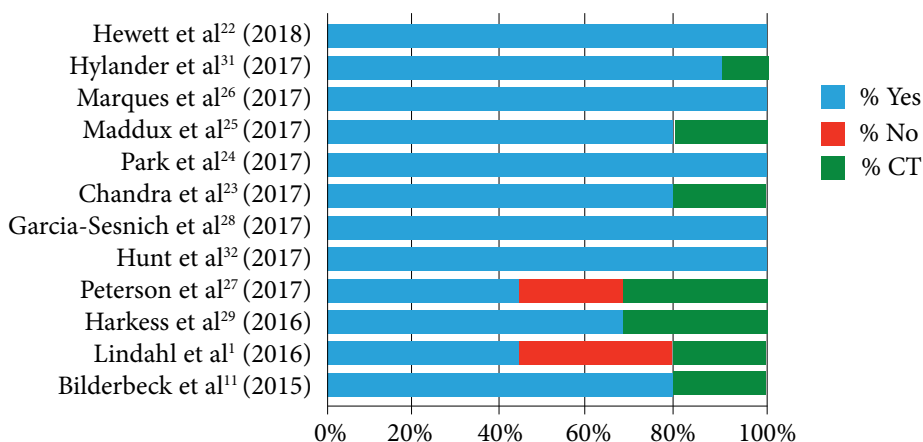
The source of stress differs in adults regarding to the life management and social engagement. We accepted only studies conducted within adults (18 years and older in this study). Trials were excluded if any participants who were clinical patients with physical or mental symptoms, shift working personnel, 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)¹⁶ 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

Figure 1. Checklist of Quality Assessment of Selected Studies



Note: %Y = percentage of “Yes”; %N = percentage of “No”; %CT = % of “Cannot tell.”

Table 2. Assessment of Risk of Bias

Studies	Adequate sequence generation?	Allocation concealment?	Blinding (of outcome assessors)	Incomplete outcome data addressed?	Selective outcome reporting?	Overall assessment of risk of bias
Hewett et al ²² (2018)	yes	yes	yes	yes	yes	Low
Hylander et al ³¹ (2017)	yes	unclear	yes	yes	yes	Uncertain
Marques et al ²⁶ (2017)	yes	yes	yes	yes	yes	Low
Maddux et al ²⁵ (2017)	yes	yes	yes	yes	yes	Low
Park et al ²⁴ (2017)	yes	yes	yes	yes	yes	Low
Chandra et al ²³ (2017)	yes	yes	yes	unclear	no	Uncertain
Garcia-Sesnich et al ²⁸ (2017)	unclear	yes	no	unclear	yes	Uncertain
Hunt et al ³² (2017)	yes	no	no	yes	yes	High
Peterson et al ²⁷ (2017)	yes	yes	no	yes	unclear	High
Harkess et al ²⁹ (2016)	yes	yes	unclear	yes	yes	Uncertain
Lindahl et al ¹ (2016)	yes	yes	no	unclear	no	High
Bilderbeck et al ¹¹ (2015)	unclear	no	yes	yes	unclear	High

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,¹⁷ 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.

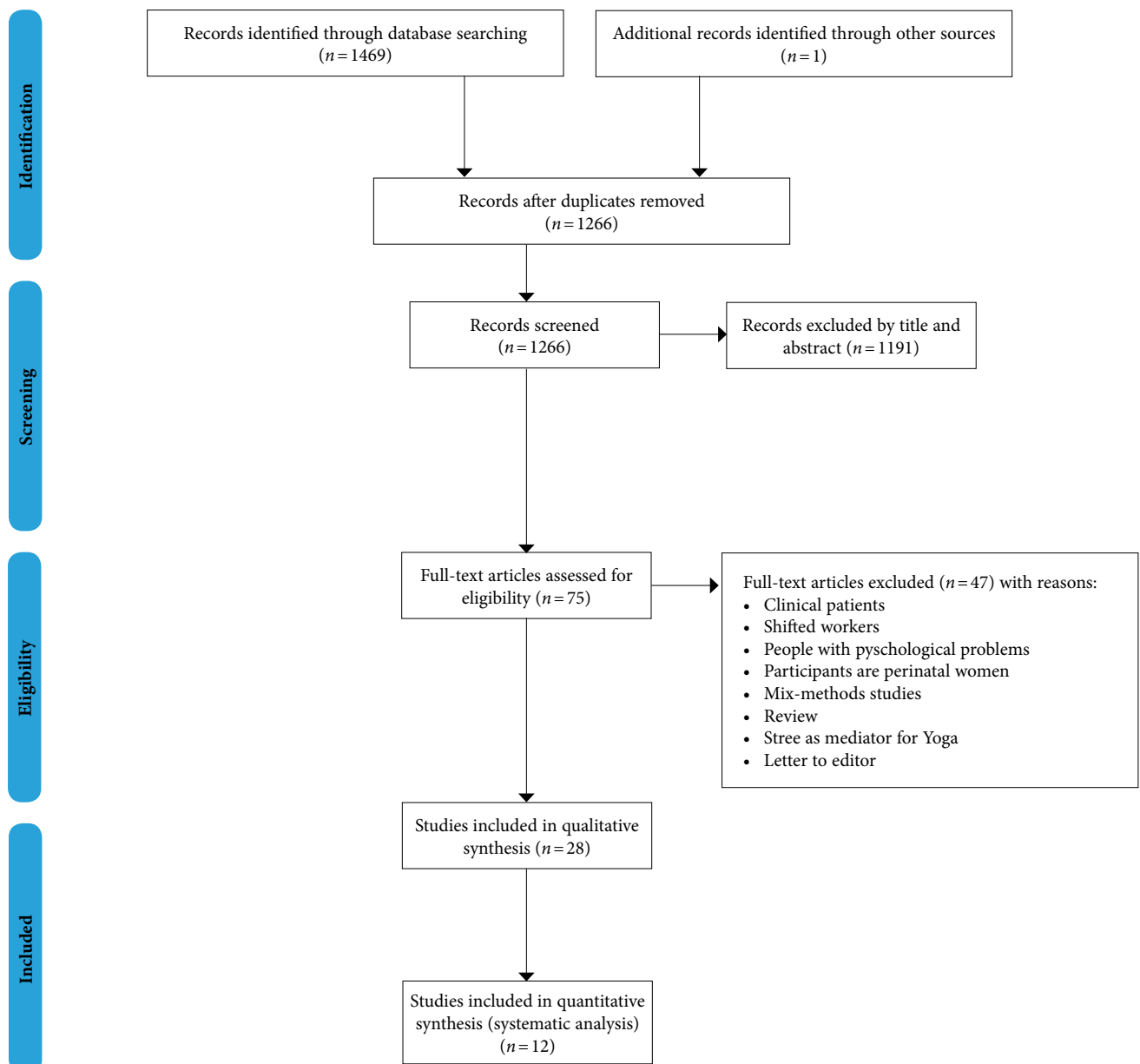
Bias Assessment

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).¹⁸ 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 5domains get an “unclear” or “no” assignment, the trial will be considered to have an “unclear or high overall risk of bias.”¹⁸ The details risk of bias assessment is listed in Table 2.

Figure 2. Study Selection Process



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 tittles 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

Table 3. The details of selected studies

Study	Participants	Intervention method	Duration	Study design	Outcome	Measurements of assessing stress
Hewett et al ²² (2018)	63 Adults (37.2 ± 10.8 y)	Bikram yoga	16 weeks	A randomized controlled trial	P.E.	10-item Perceived Stress Scale (PSS)
Hylander et al ³¹ (2017)	49 middle-aged participants	Yin yoga	5 weeks	A case-control study	P.E.	4-item Perceived Stress Scale (PSS-4)
Marques et al ²⁶ (2017)	34 women (83.16 ± 7.4 y)	Chair-based Yoga	28 weeks	Case-control study	P.E.	Perceived Stress Scale (PSS)
Maddux et al ²⁵ (2017)	80 students (mean age 46 y)	Power yoga	16 weeks	Pre-post intervention	P.E.	10-item Perceived Stress Scale (PSS)
Park et al ²⁴ (2017)	51 first-year undergraduates	Kripalu yoga	8 weeks	A randomized controlled trial	P.E.	21-item Depression, Anxiety and Stress Scale (DASS-21)
Chandra et al ²³ (2017)	20 humans aged 21- to 30-y- old	Sudarshan Kriya yoga	30 days	Case-control study	P.E.	Stress Determination Test (SDT)
Garcia-Sesnich et al ²⁸ (2017)	26 people aged 18- to 45-y-old	Kundalini Yoga	3 months	Case-control study	P.E.	Perceived Stress Scale (PSS) (Spanish version)
Hunt et al ³² (2017)	60 undergraduate students	Mindfulness training; Yoga alone	4 weeks	Case-control study Pre-post intervention	P.E.	Beck Depression Inventory (BDI) Spielberger State/Trait Anxiety Inventory
Peterson et al ²⁷ (2017)	142 individuals (43 ± 13.90 y)	Multicomponent Breath-Based Yoga	6 weeks	Pre-post intervention	P.E.	10-item Perceived Stress Scale (PSS)
Harkess et al ²⁹ (2016)	84 middle-aged women	Yoga class	2 months	A case-control trial	P.E.	Kessler Psychological Distress Scale (K10); Perceived Stress Scale (PSS)
Lindahl et al ¹ (2016)	8 participants (66.5 ± 0.3 y)	60-min Hatha yoga sessions	7 weeks	Pre-post intervention	P.E.	Perceived Stress Scale (PSS)
Bilderbeck et al ¹¹ (2015)	55 participants (prisoners)	Yoga course	10 weeks	Pre-post intervention	P.E.	Perceived Stress Scale (PSS)

Note: P.E.= Positive Effect; N.E.= Negative Effect; N/L= No effect or Lack of evidence

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),¹⁹ Depression, Anxiety and Stress Scale (DASS-21),²⁰ and Kessler Psychological Distress Scale (K10)²¹ 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.¹¹ 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 1.38.¹ 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.²² 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.²³

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.²⁴ The yoga-based intervention consisted of Kripalu yoga (a form of hatha yoga) was reported as being helpful in school and at home.²⁴ Power yoga was organized in males ($n = 43$, age: 45.5 years [10.0]) and females ($n = 43$, age: 47.1 [10.4]), and after 16 weeks’ intervention, the PSS scores dropped significantly.²⁵ 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).²⁶ 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.²⁷

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.²⁸ However, it is suggested to take long-term effect of yoga intervention into consideration. Harkess²⁹ yielded that short-term yoga

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.³⁴ 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.

REFERENCES

1. Lindahl E, Tilton K, Eickholt N, Ferguson-Stegall L. Yoga reduces perceived stress and exhaustion levels in healthy elderly individuals. *Complement Ther Clin Pract.* 2016;24:50-56.
2. Singh J. *Vijnana-Bhairava or Divine Consciousness: A Treasury Of 112 Types of Yoga*. Mumbai, India: Motilal Banarsidass Publishers; 2002.
3. Mustian KM. Yoga as treatment for insomnia among cancer patients and survivors: A systematic review. *Eur Med J Oncol.* 2013;1:106.
4. Harinath K, Malhotra A, Pal K, et al. Effects of Hatha yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. *J Altern Complement Med.* 2004;10(2):261-268.
5. Jevning R, Wallace R, Beidebach M. The physiology of meditation: A review. A wakeful hypometabolic integrated response. *Neurosci Biobehav Rev.* 1992;16(3):415-424.
6. Oken BS, Zajdel D, Kishiyama S, et al. Randomized, controlled, six-month trial of yoga in healthy seniors: Effects on cognition and quality of life. *Altern Ther Health Med.* 2006;12(1):40.
7. Thomley B, Ray S, Cha S, Bauer B. Effects of a brief, comprehensive, yoga-based program on quality of life and biometric measures in an employee population: A pilot study. *EXPLORE.* 2011;7(1):27-29.
8. Kirkwood G, Ramesh H, Tuffrey V, Richardson J, Pilkington K. Yoga for anxiety: A systematic review of the research evidence. *Br J Sports Med.* 2005;39(12):884-891.
9. Sharma M, Haider T. Yoga as an alternative and complementary therapy for patients suffering from anxiety. *Evid Based Complementary Altern Med.* 2012;18(1):15-22.

10. Javnbakht M, Hejazi Kenari R, Ghasemi M. Effects of yoga on depression and anxiety of women. *Complement Ther Clin Pract*. 2009;15(2):102-104.
11. Bilderbeck A, Brazil I, Farias M. Preliminary evidence that yoga practice progressively improves mood and decreases stress in a sample of UK prisoners. *Evid Based Complement Alternat Med*. 2015;2015:1-7.
12. Kiecolt-Glaser J, Preacher K, MacCallum R, et al. Chronic stress and age-related increases in the proinflammatory cytokine IL-6. *Proc Natl Acad Sci U S A*. 2003;100(15):9090-9095.
13. Riley K, Park C. How does yoga reduce stress? A systematic review of mechanisms of change and guide to future inquiry. *Health Psychol Rev*. 2015;9(3):379-396.
14. Liberati A. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Ann Intern Med*. 2009;151(4).
15. Stefani L, Galanti G, Padulo J, Bragazzi N, Maffulli N. sexual activity before sports Competition: A systematic review. *Front Physiol*. 2016;7:1.
16. Critical Appraisal Skills Programme. *CASP (case control study) checklist*. https://casp-uk.net/wp-content/uploads/2018/03/CASP-Case-Control-Study-Checklist-2018_fillable_form.pdf. Published 2018. Accessed 2018.
17. Guyatt G. Users' guides to the medical literature. II. How to use an article about therapy or prevention. B. What were the results and will they help me in caring for my patients? Evidence-Based Medicine Working Group. *JAMA*. 1994;271(1):59-63.
18. Higgins, Julian PT, Douglas GA, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ*. 2011;343: =d5928.
19. Beck, AT, Steer, RA, Brown, GK. Beck depression inventory-II. *San Antonio*. 1996;78(2):490-498.
20. Henry J, Crawford J. The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *Br J Clin Psychol*. 2005;44(2):227-239.
21. Andrews G, Slade T. Interpreting scores on the Kessler Psychological Distress Scale (K1). *Aust N Z J Public Health*. 2001;25(6):494-497.
22. Hewett Z, Pumpa K, Smith C, Fahey P, Cheema B. Effect of a 16-week Bikram yoga program on perceived stress, self-efficacy and health-related quality of life in stressed and sedentary adults: A randomized controlled trial. *J Sci Med Sport*. 2018;21(4):352-357.
23. Chandra S, Jaiswal A, Singh R, Jha D, Mittal A. Mental stress: Neurophysiology and its regulation by Sudarshan Kriya Yoga. *Int J Yoga*. 2017;10(2):67.
24. Park C, Riley K, Braun T, et al. Yoga and Cognitive-behavioral interventions to reduce stress in incoming college students: A pilot study. *J Appl Biobehav Res*. 2017;22(4):e12068.
25. Maddux R, Daukantaitė D, Tellhed U. The effects of yoga on stress and psychological health among employees: An 8- and 16-week intervention study. *Anx Stress Coping*. 2017;31(2):121-134.
26. Marques M, Chupel M, Furtado G, et al. Influence of chair-based yoga on salivary anti-microbial proteins, functional fitness, perceived stress and well-being in older women: A pilot randomized controlled trial. *Eur J Integr Med*. 2017;12:44-52.
27. Peterson C, Bauer S, Chopra D, Mills P, Maturi R. Effects of Shambhavi Mahamudra Kriya. A multicomponent breath-based yogic practice (pranayama), on perceived stress and general well-being. *J Evid Based Complementary Altern Med*. 2017;22(4):788-797.
28. García-Sesnich J, Flores M, Ríos M, Aravena J. Longitudinal and immediate effect of Kundalini Yoga on salivary levels of cortisol and activity of alpha-amylase and its effect on perceived stress. *Int J Yoga*. 2017;10(2):73.
29. Harkess K, Delfabbro P, Cohen-Woods S. The longitudinal mental health benefits of a yoga intervention in women experiencing chronic stress: A clinical trial. *Cogent Psychol*. 2016;3(1):1.
30. Christopher J, Christopher S, Dunnagan T, Schure M. Teaching self-care through mindfulness practices: The application of yoga, meditation, and qigong to counselor training. *J Humanist Psychol*. 2006;46(4):494-509.
31. Hylander F, Johansson M, Daukantaitė D, Ruggeri K. Yin yoga and mindfulness: A five week randomized controlled study evaluating the effects of the YOMI program on stress and worry. *Anx Stress Coping*. 2017;30(4):365-378.
32. Hunt M, Al-Braiki F, Dailey S, Russell R, Simon K. Mindfulness Training, yoga, or both? Dismantling the active components of a mindfulness-based stress reduction intervention. *Mindfulness (N Y)*. 2017;9(2):512-520.
33. Parshad, O. Role of yoga in stress management. *West Indian med J*. 2004;53(3):191-194.
34. Chong CS, Tsunaka M, Chan EP. Effects of yoga on stress management in healthy adults: A systematic review. *Altern Ther Health Med*. 2011;17(1):32.
35. Yadav R, Magan D, Mehta N, Sharma R, Mahapatra S. Efficacy of a short-term yoga-based lifestyle intervention in reducing stress and inflammation: Preliminary results. *J Altern Complem Med*. 2012;18(7):662-667.
36. Cruz-Jentoft A, Baeyens J, Bauer J, et al. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. *Age Ageing*. 2010;39(4):412-423.
37. Bowman AJ, Clayton RH, Murray A, Reed JW, Subhan MM, Ford GA. Effects of aerobic exercise training and yoga on the baroreflex in healthy elderly persons. *Eur J Clin Invest*. 1997;27(5): 443-449.
38. Granath J, Ingvarsson S, von Thiele U, Lundberg U. Stress management: A randomized study of cognitive behavioural therapy and yoga. *Cogn Behav Ther*. 2006;35(1):3-10.
39. Ji L. Exercise at old age: Does it increase or alleviate oxidative stress?. *Ann N Y Acad Sci*. 2006;928(1):236-247.