Hapres | Advances in Geriatric Medicine and Research

agmr.hapres.com

*Viewpoint*

# Yoga for Healthy Aging: Science or Hype?

**Purnima Madhivanan [1,2,3,*], Karl Krupp [1,3], Randall Waechter [4,5], Rahu Shidhaye [6]**

[1] Mel & Enid Zuckerman College of Public Health, University of Arizona, Tucson, Arizona 85724-5209, USA

[2] College of Medicine, University of Arizona, Tucson, Arizona 85724-5209, USA

[3] Public Health Research Institute of India, Mysore, Karnataka 560020, India

[4] School of Medicine, St. George's University, Grenada, West Indies

[5] School of Graduate Studies, St. George's University, Grenada, West Indies

[6] Pravara Institute of Medical Sciences, Loni 413713, India

* Correspondence: Purnima Madhivanan, pmadhivanan@arizona.edu; Tel.: +1-520-621-5730.

**ABSTRACT**

Yoga, one of the world's oldest health systems is receiving new attention for claims that it can contribute to healthy aging. Until recently, scientific evidence for its efficacy has relied heavily on small and poorly-designed research, but this is changing. Multiple, well-designed studies provide data showing that yoga practice has positive effects on cellular aging, mobility, balance, mental health, and prevention of cognitive decline—all areas of concern for older adults. Since the cost of implementing yoga-based community and home-based interventions is low—policymakers are also eyeing yoga practice as a cost-effective way to reduce medical costs and improve outcomes among a growing aging population. This commentary reviews the evidence for both physical and mental health benefits from yoga, as well as concerns about injuries that have been associated with certain types of yoga practice. It reveals a surprising range of yoga programs and difficulty levels that provide opportunities for almost anyone to participate and gain health benefits with practice.

**KEYWORDS:** yoga; aging; mental health; physical health

**Open Access**

Received: 27 February 2021
Accepted: 08 July 2021
Published: 13 July 2021



Yoga's roots can be traced to 1000 BCE and source texts with varying definitions for postures *(asanas)*, breath control, meditation, and spiritual practices. Most contemporary practice is based on Hatha yoga that is largely defined by physical practice [1]. The *Pradīpikā*, a Sanskrit manual written in 1350 describes fifteen primary postures, seven performed while seated, and eight in other positions, along with 69 combined postures for a total of 84 asanas [2]. Recent interventions have adapted these for a variety of health conditions problems in aging [3], pregnancy [4], chronic pain [5], diabetes [6], stroke [7], heart failure, mild traumatic brain injury and brain health in addition to many others [8,9]. More recent styles of yoga including *Vinyasa*, Iyengar, *Ashtanga*, *Kundalini*, and others have

refined these postures, or put a varying emphasis on alignment, breath control, speed, and flow from one posture to another, adding various non-physical elements including meditation, relaxation, guided imagery, and commitments to particular diets and lifestyles [10]. Interventions using modified or adapted yoga postures and movements for people with medical limitations include Gentle Chair Yoga [11,12], group yoga interventions with psychoeducation for traumatic brain injury patients [13,14], *Hatha* yoga for increased balance and mobility in people 60 years and older [15], and Functional Fitness in adults with intellectual and developmental disabilities [16] among many others [17,18]. Intervention modifications depend on the medical condition; Prenatal Yoga is based on trimester and often eliminates positions like inversions to minimize risk of falling, and proning that may result in pressure point-related side effects [4]. Gentle Years Yoga for older adults uses a mixture of standing, seated, kneeling, supine, and prone stationary positions but alters *Hatha* Yoga poses to make them accessbile and safe for inactive older adults with comorbidities and physical and balance limitations [19]. Finally, some interventions focus on smaller movements, breathing and meditation that can safely be carried out either seated on a chair or in a wheel chair [11,12].

Many studies suggest that yoga practice is generally safe but as with any exercise, there are risks even for healthy people [20–22]. A survey of 2508 people with chronic diseases or ambulatory hospital outpatients attending yoga classes in Japan, and 271 yoga therapists, found that muscular pain was most common adverse even (5.3%), followed by joint pain (4.9%), muscle cramps (1.7%), dizziness (4.0%), numbness (1.9%), muscle twitching (1.6%), faintness (1.3%), heaviness of the head (1.0%), coughing (3.2%), nasal congestion (1.2%) runny nose (1.1%) [22]. The vast majority of adverse events were minor and transitory with only 1.9% of participants reporting adverse outcomes serious enough that they discontinued practice [22]. Studies suggest that almost all yoga postures can be modified and evidenced-based yoga programs can address specific deficits in strength and muscular endurance through the choice and modification of specific postures to reduce risk for adverse events and injuries [23]. Research also shows that that expert instruction and adaptation of poses to the limitations and needs of the participants with the use of blocks, straps, blankets, a support, or chair are useful and protective for users with physical limitations [24].

Recent research supports the hypothesis that yoga counteracts aging processes. Tolahunase and colleagues demonstrated that a 12-week intervention incorporating classical yoga postures, breathing exercises, and meditation was associated with positive changes in the levels of biomarkers of cellular aging including 8-OH2dG, a product of DNA damage; oxidative stress markers; and telomeres, the cellular clocks that shorten with each cell replication [25]. Santaella et al. examined the impact of long-term yoga practice on connectivity between the prefrontal

and posterior cortex of the brain [26]—the network of interconnecting neurons that transfers data related to working-memory, spatial attention, and decision-making [26,27]. They showed that older women practicing yoga for at least 8 years had better functional brain connectivity compared with yoga-naïve controls [28]. Cahn and colleagues found that a 90-day yoga and meditation retreat was associated with reductions in brain-derived neurotrophic factor, Hypothalamic-Pituitary Axis activity, increased IL-10 and decreased IL-12 indicators of lower overall inflammatory activity that has been associated with premature aging [29].

Yoga practice has also been shown to have positive neurological and mental health benefits [30,31]. A systematic review and meta-analysis of yoga practice on brain structure [31], found that regular practice was associated with anatomical changes in the frontal cortex, hippocampus, anterior cingulate cortex and insula—all areas implicated in aging-related cognitive decline. Other studies have similarly shown that yoga practice also has benefits for mental health. Gupta et al. found that yoga had both immediate and long-term impacts on State and Trait anxiety score [32]. Gururaja and colleagues showed that seniors age 65 to 75 years who participated in 90 minutes of yoga classes once or twice weekly for a month, had significant reductions in state and trait anxiety scores [33]. A systematic review and meta-analysis examining the impact of yoga practice on depression symptomatology also showed significant reductions (standardised mean difference = 0.41; 95% CI −0.65 to −0.17; $p < 0.001$) compared to waitlist controls, with increasing practice associated with additional benefits ($\beta = -0.44$, $p < 0.01$) [30]. Collectively, these findings suggest that yoga may be useful for mitigating age-related and neurodegenerative declines in older adults.

Yoga has also been found useful in maintaining physical mobility and functional independence in seniors [34]. A 10-country study of sedentary behavior among 350,000 adults age 60 and older, found that the average senior spends 9.4 h a day in sedentary activities—putting them at high-risk for premature aging [35,36]. Grabara and Szopa studied 56 women ranging in age from 50 to 79 years who attended a 20-week yoga retreat using pre- and post-measures of spine mobility [37] and found yoga practice was associated with greater muscle flexibility and a greater range of motion. Intervention participants demonstrated greater spinal mobility, more overall back strength, and more strength in their abdominal oblique muscles. In addition, a systematic review and meta-analysis of six clinical trials of yoga-based exercise interventions among individuals 60 and older, found an effect on balance (Hedges' $g = 0.40$, 95% CI 0.15–0.65, 6 trials) and physical mobility (Hedges' $g = 0.50$, 95% CI 0.06–0.95, 3 trials) [15]. Three trials in the review reported minor injuries including knee pain, lower back pain, and muscle strain; one reported a fall with no injuries, and two reported no adverse events. Beyond the physical benefits, yoga was also found to improve health related quality of life and mental well-being in older adults [38].

Finally, feasibility studies among older adults show high acceptability for yoga interventions [34,39]. Ranging in difficulty from 'Chair yoga' for older adults with mobility-impairments, to moderately strenuous traditional *Hatha* yoga for those that are more fit, almost all participants report feeling more limber and mobile, and many note reduction in chronic pain [39]. A study that examined willingness of seniors to engage in a yoga intervention also found that the top three barriers expressed were fears about the level of difficulty, a lack of motivation to engage in new practice, and fear of injury [40].

While everyone should consult their physician before starting a physical regimen, yoga appears to have a wide range of benefits including increased mobility; reduced risk for slip and fall; protection against cognitive decline; increased flexibility, strength, and balance; and improved sleep and mental well-being. The typical intervention is of moderate duration, around 45 min per week for 8 to 12 weeks. The range of intervention types and difficulty levels provide the opportunity for almost anyone to participate and gain health benefits. The quality of scientific evidence for traditional yoga practice is also improving with larger, better designed studies showing small to moderate benefits for most people in line with other forms of exercise programs [15]. Choosing an appropriate program for healthy aging come with the same cautions for any exercise in older adults [41]. Seniors are advised to start with lower-intensity activity and slowly increase the duration and difficulty to minimize risk of injury. Yoga practice offers both mental and physical benefits and different forms offer variations in emphasis [41]. For those more interested in cognitive benefits, 'gentle yoga' offers a slower pace and more focus on meditation and relaxation, while others may be more interested in improved flexibility or fitness, goals that would better be served by a more strenuous *Hatha* yoga program [42,43].

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

## FUNDING

PM acknowledges current funding support from NIH/FIC under Award Number D43 TW010540 and NIH/NIA Award Number R03 AG069796.

## REFERENCES

1. Mallinson J, Singleton M. Roots of Yoga. London (UK): Penguin Books; 2017.
2. Muktibodhananda S. Hatha Yoga Pradipika. 3rd ed. Munger (India): Bihar School of Yoga. 2013.
3. Osth J, Diwan V, Jirwe M, Diwan V, Choudhary A, Mahadik VK, et al. Effects of yoga on well-being and healthy ageing: study protocol for a randomised controlled trial (FitForAge). BMJ Open. 2019;9(5):e027386.

4. Curtis K, Weinrib A, Katz J. Systematic review of yoga for pregnant women: current status and future directions. Evid Based Complement Alternat Med 2012;2012:715942.
5. Vallath N. Perspectives on yoga inputs in the management of chronic pain. Indian J Palliat Care 2010;16(1):1-7.
6. Raveendran AV, Deshpandae A, Joshi SR. Therapeutic Role of Yoga in Type 2 Diabetes. Endocrinol Metab. 2018;33(3):307-17.
7. Schmid AA, Van Puymbroeck M, Altenburger PA, Schalk NL, Dierks TA, Miller KK, et al. Poststroke balance improves with yoga: a pilot study. Stroke 2012;43(9):2402-7.
8. Acabchuk RL, Brisson JM, Park CL, Babbott-Bryan N, Parmelee OA, Johnson BT. Therapeutic Effects of Meditation, Yoga, and Mindfullness-Based Interventions for Chronic Symptoms of Mild Traumatic Brain Injury: A Systematic Review and Meta-Analysis. Appl Psychol. 2021;13(1):34-62.
9. McCall MC, Ward A, Roberts NW, Heneghan C. Overview of systematic reviews: yoga as a therapeutic intervention for adults with acute and chronic health conditions. Evid Based Complement Alternat Med. 2013;2013:945895.
10. Brems C, Colgan D, Freeman H, Freitas J, Justice L, Shean M, et al. Elements of yogic practice: Perceptions of students in healthcare programs. Int J Yoga. 2016;9(2):121-9.
11. Park J, McCaffrey R, Newman D, Liehr P, Ouslander JG. A Pilot Randomized Controlled Trial of the Effects of Chair Yoga on Pain and Physical Function Among Community-Dwelling Older Adults With Lower Extremity Osteoarthritis. J Am Geriatr Soc. 2017;65(3):592-7.
12. Park J, Newman D, McCaffrey R, Garrido JJ, Riccio ML, Liehr P. The Effect of Chair Yoga on Biopsychosocial Changes in English- and Spanish-Speaking Community-Dwelling Older Adults with Lower-Extremity Osteoarthritis. J Gerontol Soc Work. 2016;59(7-8):604-26.
13. Donnelly KZ, Baker K, Pierce R, St Ivany AR, Barr PJ, Bruce ML. A retrospective study on the acceptability, feasibility, and effectiveness of LoveYourBrain Yoga for people with traumatic brain injury and caregivers. Disabil Rehabil. 2021;43(12):1764-75.
14. Donnelly KZ, Goldberg S, Fournier D. A qualitative study of LoveYourBrain Yoga: a group-based yoga with psychoeducation intervention to facilitate community integration for people with traumatic brain injury and their caregivers. Disabil Rehabil 2020; 42(17):2482-91.
15. Youkhana S, Dean CM, Wolff M, Sherrington C, Tiedemann A. Yoga-based exercise improves balance and mobility in people aged 60 and over: a systematic review and meta-analysis. Age Ageing. 2016;45(1):21-9.
16. Reina AM, Adams EV, Allison CK, Mueller KE, Crowe BM, van Puymbroeck M, et al. Yoga for Functional Fitness in Adults with Intellectual and Developmental Disabilities. Int J Yoga. 2020;13(2):156-9.
17. Danhauer SC, Addington EL, Sohl SJ, Chaoul A, Cohen L. Review of yoga therapy during cancer treatment. Support Care Cancer. 2017;25(4):1357-72.
18. Pullen PR, Seffens WS, Thompson WR. Yoga for Heart Failure: A Review and Future Research. Int J Yoga. 2018;11(2):91-8.

19. Tew GA, Howsam J, Hardy M, Bissell L. Adapted yoga to improve physical function and health-related quality of life in physically-inactive older adults: a randomised controlled pilot trial. BMC Geriatr. 2017;17(1):131.
20. Cramer H, Krucoff C, Dobos G. Adverse events associated with yoga: a systematic review of published case reports and case series. PLoS One 2013;8(10):e75515.
21. Cramer H, Ostermann T, Dobos G. Injuries and other adverse events associated with yoga practice: A systematic review of epidemiological studies. J Sci Med Sport. 2018;21(2):147-54.
22. Matsushita T, Oka T. A large-scale survey of adverse events experienced in yoga classes. Biopsychosoc Med. 2015;9:9.
23. Wang MY, Yu SS, Hashish R, Samarawickrame SD, Kazadi L, Greendale GA, et al. The biomechanical demands of standing yoga poses in seniors: The Yoga empowers seniors study (YESS). BMC Complement Altern Med. 2013;13:8.
24. Thind H, Guthrie KM, Horowitz S, Conrad M, Bock BC. "I can do almost anything": The experience of adults with type 2 diabetes with a yoga intervention. Complement Ther Clin Pract. 2019;34:116-22.
25. Tolahunase M, Sagar R, Dada R. Impact of Yoga and Meditation on Cellular Aging in Apparently Healthy Individuals: A Prospective, Open-Label Single-Arm Exploratory Study. Oxid Med Cell Longev. 2017;2017:7928981.
26. Santaella DF, Balardin JB, Afonso RF, Giorjiani GM, Sato JR, Lacerda SS, et al. Greater Anteroposterior Default Mode Network Functional Connectivity in Long-Term Elderly Yoga Practitioners. Front Aging Neurosci. 2019;11:158.
27. Katsuki F, Constantinidis C. Unique and shared roles of the posterior parietal and dorsolateral prefrontal cortex in cognitive functions. Front Integr Neurosci 2012; 6:17.
28. Cera N, Esposito R, Cieri F, Tartaro A. Altered Cingulate Cortex Functional Connectivity in Normal Aging and Mild Cognitive Impairment. Front Neurosci 2019; 13:857.
29. Cahn BR, Goodman MS, Peterson CT, Maturi R, Mills PJ. Yoga, Meditation and Mind-Body Health: Increased BDNF, Cortisol Awakening Response, and Altered Inflammatory Marker Expression after a 3-Month Yoga and Meditation Retreat. Front Hum Neurosci 2017; 11:315.
30. Brinsley J, Schuch F, Lederman O, Girard D, Smout M, Immink MA, et al. Effects of yoga on depressive symptoms in people with mental disorders: a systematic review and meta-analysis. Br J Sports Med. 2020;bjsports-2019-101242.
31. Gothe NP, Khan I, Hayes J, Erlenbach E, Damoiseaux JS. Yoga Effects on Brain Health: A Systematic Review of the Current Literature. Brain Plast. 2019;5(1):105-22.
32. Gupta N, Khera S, Vempati RP, Sharma R, Bijlani RL. Effect of yoga based lifestyle intervention on state and trait anxiety. Indian J Physiol Pharmacol. 2006;50(1):41-7.
33. Gururaja D, Harano, K., Toyotake, I., Kobayashi, H. Effect of yoga on mental health: Comparative study between young and senior subjects in Japan. Int J Yoga. 2011;4(1):7-12.

34. Groessl EJ, Maiya M, Schmalzl L, Wing D, Jeste DV. Yoga to prevent mobility limitations in older adults: feasibility of a randomized controlled trial. BMC Geriatr. 2018;18(1):306.
35. Harvey JA, Chastin SF, Skelton DA. How Sedentary are Older People? A Systematic Review of the Amount of Sedentary Behavior. J Aging Phys Act. 2015;23(3):471-87.
36. Owen N, Sparling PB, Healy GN, Dunstan DW, Matthews CE. Sedentary behavior: emerging evidence for a new health risk. Mayo Clin Proc. 2010;85(12):1138-41.
37. Grabara M, Szopa J. Effects of hatha yoga exercises on spine flexibility in women over 50 years old. J Phys Ther Sci. 2015;27(2):361-5.
38. Tulloch A, Bombell H, Dean C, Tiedemann A. Yoga-based exercise improves health-related quality of life and mental well-being in older people: a systematic review of randomised controlled trials. Age Ageing. 2018;47(4):537-44.
39. Van Puymbroeck M, Schmid A, Walter A, Hawkins B. Improving Leisure Constraints in Older Adults with a Fear of Falling through Hatha Yoga: an Acceptability and Feasibility Study Int J Gerontol Geriatr Res. 2017;1(1):8-13.
40. Perkins R, Dassel K, Felsted KF, Towsley G, Edelman L. Yoga for Seniors: Understanding Their Beliefs About, and Barriers to Participation. Educ Gerontol. 2020;46(7):382-92.
41. McAlinden C, Khadka J, Pesudovs K. Statistical methods for conducting agreement (comparison of clinical tests) and precision (repeatability or reproducibility) studies in optometry and ophthalmology. Ophthalmic Physiol Opt. 2011;31(4):330-8.
42. Smith S, Frates B. A Physician's Guide to Recommending Yoga. Am J Lifestyle Med. 2018;12(4):298-301.
43. John Hopkins Medicine. 9 Benefits of Yoga. Available from: https://wwwhopkinsmedicineorg/health/wellness-and-prevention/9-benefits-of-yoga. Accessed on 2021 Feb 27.



How to cite this article:
Madhivanan P, Krupp K, Waechter R, Shidhaye R. Yoga for Healthy Aging: Science or Hype? Adv Geriatr Med Res. 2021;3(3):e210016. https://doi.org/10.20900/agmr20210016