

## Publications Overview

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The Kripalu Institute for Extraordinary Living (KIEL) works with scientists to understand and record the impact of yoga. This document lists and provides abstracts of KIEL-sponsored publications. The articles are grouped into five categories: Yoga for Self-Regulation, Yoga and Adolescents, Yoga and Frontline Professionals, Yoga and the Brain, and Yoga for Diverse and Underserved Populations. They are further organized by date of publication.

## Yoga for Self-Regulation

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**Potential Self-regulatory Mechanisms of Yoga for Psychological Health. *Frontiers in Human Neuroscience*. Gard, T., Noggle, J., Park, C., Vago, D., & Wilson, A. (2014)**

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4179745/>

**ABSTRACT:** Research suggesting the beneficial effects of yoga on myriad aspects of psychological health has proliferated in recent years, yet there is currently no overarching framework by which to understand yoga's potential beneficial effects. Here we provide a theoretical framework and systems-based network model of yoga that focuses on integration of top-down and bottom-up forms of self-regulation. We begin by contextualizing yoga in historical and contemporary settings, and then detail how specific components of yoga practice may affect cognitive, emotional, behavioral, and autonomic output under stress through an emphasis on interoception and bottom-up input, resulting in physical and psychological health. The model describes yoga practice as a comprehensive skillset of synergistic process tools that facilitate bidirectional feedback and integration between high- and low-level brain networks, and afferent and re-afferent input from interoceptive processes (somatosensory, viscerosensory, chemosensory). From a predictive coding perspective we propose a shift to perceptual inference for stress modulation and optimal self-regulation. We describe how the processes that subserve self-regulation become more automatized and efficient over time and practice, requiring less effort to initiate when necessary and terminate more rapidly when no longer needed. To support our proposed model, we present the available evidence for yoga affecting self-regulatory pathways, integrating existing constructs from behavior theory and cognitive neuroscience with emerging yoga and meditation research. This paper is intended to guide future basic and clinical research, specifically targeting areas of development in the treatment of stress-mediated psychological disorders

## Yoga and Adolescents

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**Implementing yoga within the school curriculum: a scientific rationale for improving social-emotional learning and positive student outcomes.** *Journal of Children's Services*. Butzer, B., Bury, D., Telles, S., & Khalsa, S. B. (2016)

<http://www.emeraldinsight.com/doi/abs/10.1108/JCS-10-2014-0044>

**ABSTRACT:** Purpose – The purpose of this paper is to review and synthesise research evidence and propose a theoretical model suggesting that school-based yoga programs may be an effective way to promote socialemotional learning (SEL) and positive student outcomes. Design/methodology/approach – This paper is a literature review focusing on: the current state of research on school-based yoga interventions; a preliminary theoretical model outlining the potential mechanisms and effects of school-based yoga; similarities, differences and possibilities for integrating school-based SEL, yoga and meditation; practical implications for researching and implementing yoga in schools. Findings – Research suggests that providing yoga within the school curriculum may be an effective way to help students develop self-regulation, mind-body awareness and physical fitness, which may, in turn, foster additional SEL competencies and positive student outcomes such as improved behaviours, mental state, health and performance. Research limitations/implications – Given that research on school-based yoga is in its infancy, most existing studies are preliminary and are of low to moderate methodological quality. It will be important for future research to employ more rigorous study designs. Practical implications – It is possible, pending additional high-quality research, that yoga could become a well-accepted component of school curricula. It will be particularly important for future research to examine possibilities around integrating school-based yoga and meditation with SEL programs at the individual, group and school-wide levels. Originality/value – This paper is the first to describe a theoretical model specifically focused on school-based yoga interventions, as well as a discussion of the similarities and differences between school-based yoga, SEL and meditation.

**Yoga in school settings: a research review.** *Annals of the New York Academy of Sciences*. Butzer, B. & Khalsa, S. B. (2016)

<http://www.ncbi.nlm.nih.gov/pubmed/26919395> \*

**ABSTRACT:** Research on the efficacy of yoga for improving mental, emotional, physical, and behavioral health characteristics in school settings is a recent but growing field of inquiry. This systematic review of research on school-based yoga interventions published in peer-reviewed journals offers a bibliometric analysis that identified 47 publications. The studies from these publications have been conducted primarily in the United States ( $n = 30$ ) and India ( $n = 15$ ) since 2005, with the majority of studies ( $n = 41$ ) conducted from 2010 onward. About half of the publications were of studies at elementary schools; most (85%) were conducted within the school curriculum, and most (62%) also implemented a formal school-based yoga program. There was a high degree of variability in yoga intervention characteristics, including overall duration, and the number and duration of sessions. Most of these published research trials are preliminary in nature, with numerous study design limitations, including limited sample sizes (median= 74; range = 20–660) and relatively weak research designs (57% randomized controlled trials, 19% uncontrolled trials), as would be expected in an infant research field. Nevertheless, these publications suggest that yoga in the school setting is a viable and potentially efficacious strategy for improving child and adolescent health and therefore worthy of continued research.

Yoga Enhances Positive Psychological States in Young Adult Musicians. *Applied Psychophysiology and Biofeedback*. Butzer, B., Ahmed, K., & Khalsa, S. B. (2016)

<http://www.ncbi.nlm.nih.gov/pubmed/26721471> \*

ABSTRACT: Although yoga has been shown to be a viable technique for improving the performance of the mind and body, little attention has been directed to studying the relationship between yoga and the psychological states of flow and mindfulness. Musicians enrolled in a 2-month fellowship program in 2005, 2006 and 2007 were invited to participate in a yoga and meditation program. Fellows not participating in the yoga program were recruited separately as controls. All participants completed baseline and end program questionnaires evaluating dispositional flow, mindfulness, confusion, and music performance anxiety. Compared to controls, yoga participants reported significant decreases in confusion and increases in dispositional flow. Yoga participants in the 2006 sample also reported significant increases in the mindfulness subscale of awareness. Correlational analyses revealed that increases in participants' dispositional flow and mindfulness were associated with decreases in confusion and music performance anxiety. This study demonstrates the commonalities between positive psychology and yoga, both of which are focused on enhancing human performance and promoting beneficial psychological states. The results suggest that yoga and meditation may enhance the states of flow and mindful awareness, and reduce confusion.

School-based Yoga Programs in the United States: A Survey. *Advances in Mind-Body Medicine*. Butzer, B., Ebert, M., Telles, S., & Khalsa, S. B. (2015)

<http://www.ncbi.nlm.nih.gov/pubmed/26535474> \*

ABSTRACT: Context • Substantial interest has begun to emerge around the implementation of yoga interventions in schools. Researchers have found that yoga practices may enhance skills such as self-regulation and prosocial behavior, and lead to improvements in students' performance. These researchers, therefore, have proposed that contemplative practices have the potential to play a crucial role in enhancing the quality of US public education. Objective • The purpose of the present study was to provide a summary and comparison of school-based yoga programs in the United States. Design • Online, listserv, and database searches were conducted to identify programs, and information was collected regarding each program's scope of work, curriculum characteristics, teacher-certification and training requirements, implementation models, modes of operation, and geographical regions. Setting • The online, listserv, and database searches took place in Boston, MA, USA, and New Haven, CT, USA. Results • Thirty-six programs were identified that offer yoga in more than 940 schools across the United States, and more than 5400 instructors have been trained by these programs to offer yoga in educational settings. Despite some variability in the exact mode of implementation, training requirements, locations served, and grades covered, the majority of the programs share a common goal of teaching 4 basic elements of yoga: (1) physical postures, (2) breathing exercises, (3) relaxation techniques, and (4) mindfulness and meditation practices. The programs also teach a variety of additional educational, social-emotional, and didactic techniques to enhance students' mental and physical health and behavior. Conclusions • The fact that the present study was able to find a relatively large number of formal, school-based yoga programs currently being implemented in the United States suggests that the programs may be acceptable and feasible to implement. The results also suggest that the popularity of school-based yoga programs may continue to grow.

Yoga May Mitigate Decreases in High School Grades. *Evidence-Based Complementary and Alternative Medicine*. Butzer, B., van Over, M., Noggle, J., & Khalsa, S. B. (2015)

<http://www.hindawi.com/journals/ecam/2015/259814/>

ABSTRACT: This study involves an exploratory examination of the effects of a 12-week school-based yoga intervention on changes in grade point average (GPA) in 9th and 10th grade students. Participants included 95 high school students who had registered for physical education (PE) in spring 2010. PE class sections were group randomized to receive either a yoga intervention or a PE-as-usual control condition. The yoga intervention took place during the entire third quarter and half of the fourth quarter of the school year, and quarterly GPA was collected via school records at the end of the school year. Results revealed a significant interaction between group and quarter suggesting that GPA differed between the yoga and control groups over time. Post hoc tests revealed that while both groups exhibited a general decline in GPA over the school year, the control group exhibited a significantly greater decline in GPA from quarter 1 to quarter 3 than the yoga group. Both groups showed equivalent declines in GPA in quarter 4 after the yoga intervention had ended. The results suggest that yoga may have a protective effect on academic performance by preventing declines in GPA; however these preventive effects may not persist once yoga practice is discontinued.

Yoga in Public School Improves Adolescent Mood and Affect. *Contemp School Psychol*. Felver, J., Butzer, B., Olson, K., Smith, I., & Khalsa, S. B. (2014)

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4605219/>

ABSTRACT: The purpose of the present study was to directly compare the acute effects of participating in a single yoga class versus a single standard physical education (PE) class on student mood. Forty-seven high school students completed self-report questionnaires assessing mood and affect immediately before and after participating in a single yoga class and a single PE class one week later. Data were analyzed using paired-samples t tests and Wilcoxon-signed ranks tests and by comparing effect sizes between the two conditions. Participants reported significantly greater decreases in anger, depression, and fatigue from before to after participating in yoga compared to PE. Significant reductions in negative affect occurred after yoga but not after PE; however, the changes were not significantly different between conditions. In addition, after participating in both yoga and PE, participants reported significant decreases in confusion and tension, with no significant difference between groups. Results suggest that school-based yoga may provide unique benefits for students above and beyond participation in PE. Future research should continue to elucidate the distinct psychological and physiological effects of participating in yoga compared to PE activities.

Yoga Reduces Performance Anxiety in Adolescent Musicians. *Alternative Therapies*. Khalsa, S. B., Reinhardt, K., Butzer, B., Shorter, S., & Cope, S. (2013)

<http://www.ncbi.nlm.nih.gov/pubmed/23594451> \*

ABSTRACT: Professional musicians often experience high levels of stress, music performance anxiety (MPA), and performance-related musculoskeletal disorders (PRMDs). Given the fact that most professional musicians begin their musical training before the age of 12, it is important to identify interventions that will address these issues from an early age. Objective: This study intended to replicate and expand upon adult research in this area by evaluating the effects of a yoga intervention on MPA and PRMDs in a population of adolescent musicians. The present study was the first to examine these effects. Design: The research team assigned participants, adolescent musicians, into two groups. The intervention group (n = 84) took part in a 6-wk yoga program, and the control group (n = 51) received no treatment. The team evaluated the effects of the yoga intervention by comparing the scores of the intervention group to those of the control group on a number of questionnaires related to MPA and PRMDs. Setting: The study was conducted at the Boston University Tanglewood Institute (BUTI). BUTI is a training academy for advanced adolescent musicians, located in Lenox, Massachusetts. Participants: Participants were adolescent, residential music students (mean age = 16 y) in a 6-wk summer program at the BUTI in 2007 and 2008. Intervention: Participants in the yoga intervention group were requested to attend three, 60-min, Kripalu-style yoga classes each week for 6 weeks. Outcome Measures: MPA was measured using the Performance Anxiety Questionnaire (PAQ) and the Music Performance Anxiety Inventory for Adolescents (MPAI-A). PRMDs were measured using the Performance-Related Musculoskeletal Disorders Questionnaire (PRMD-Q). Results • Yoga participants showed statistically significant reductions in MPA from baseline to the end of the program compared to the control group, as measured by several subscales of the PAQ and MPAI-A; however, the results for PRMDs were inconsistent. Conclusion: The findings suggest that yoga may be a promising way for adolescents to reduce MPA and perhaps even prevent it in the future. These findings also suggest a novel treatment modality that potentially might alleviate MPA and prevent the early disruption and termination of musical careers.

**Qualitative Evaluation of a High School Yoga Program: Feasibility and Perceived Benefits.** *Explore: The Journal of Science and Healing.* Conboy, L., Noggle, J., Frey, J., Kudesia, R., & Khalsa, S. B. (2013)

<http://www.ncbi.nlm.nih.gov/pubmed/23643372> \*

**ABSTRACT:** This is the first published qualitative assessment of a yoga program applied in a high school setting. This qualitative interview study was nested in a randomized, controlled trial studying the effects of a yoga program offered in place of a semester of physical education classes at a rural public high school. Student interviews were conducted following a semester of the yoga program. A formal passive consent with information about the qualitative study was sent home to parents/guardians of all students in the parent study prior to the interviews. Most students enjoyed the yoga classes and felt benefits. Negative reports of yoga practice were associated with gender as most males sensed peer pressure against practicing yoga. Despite this finding, most students wanted to continue yoga and would continue if it were offered in school. Positive reports include a greater kinesthetic awareness which some students association with a greater respect for the body and improved self-image. Among students reporting psychological benefits, many cited stress reduction; many used yoga to manage negative emotions; some propagated more optimism. Most thought yoga could reduce interest in the use of drugs and alcohol and increase social cohesion with family and peers. We found that a yoga program is feasible in this sample of 9th and 10th graders, especially after benefits are perceived. We also found evidence that yoga may lead to emergent positive benefits in health behaviors not directly prescribed by the program. These results suggest that school-based yoga programs may be appropriate for promoting healthy behaviors at a societal level by focusing on the prevention of negative patterns during the adolescent transition.

**Effects of a Yoga-Based Intervention for Young Adults on Quality of Life and Perceived Stress: The Potential Mediating Roles of Mindfulness and Self-Compassion.** *The Journal of Positive Psychology.* Gard, T., Brach, N., Hölzel, B., Noggle, J., Conboy, L.A., & Lazar, S. (2012)

<http://www.tandfonline.com/doi/abs/10.1080/17439760.2012.667144>

**ABSTRACT:** The purpose of this pilot study was to investigate the effects of a yoga-based program on quality of life, perceived stress, mindfulness, and self-compassion in young adults. These variables were measured in 33 self-selected participants of a four-month residential yoga intervention before and after the program. Forty-three demographically matched controls completed the same questionnaires at two time points with a four-month interval in between. Participation in the program predicted increases in quality of life and decreases in perceived stress, mediated by mindfulness and self-compassion. Multiple mediator models revealed that the effect of group on quality of life was simultaneously mediated by mindfulness and self-compassion, while the effect of group on perceived stress was only mediated by self-compassion. These positive effects on perceived stress and quality of life suggest that yoga-based interventions may be of value in cultivating subjective well-being in young adults. Furthermore, yoga-based and mindfulness-based interventions may share underlying mechanisms.

**Benefits of Yoga for Psychosocial Well-Being in a US High School Curriculum: A Preliminary Randomized Controlled Trial.** *Journal of Developmental & Behavioral Pediatrics*. Noggle, J., Steiner, N., Minami, T., & Khalsa, S.B. (2012)

<http://www.ncbi.nlm.nih.gov/pubmed/22343481> \*

**ABSTRACT:** Objective: To test feasibility of yoga within a high school curriculum and evaluate preventive efficacy for psychosocial well-being. Methods: Grade 11 or 12 students (N = 51) who registered for physical education (PE) were cluster-randomized by class 2:1 yoga : PE-as-usual. A Kripalu-based yoga program of physical postures, breathing exercises, relaxation, and meditation was taught 2 to 3 times a week for 10 weeks. Self-report questionnaires were administered to students 1 week before and after. Primary outcome measures of psychosocial well-being were Profile of Mood States—Short Form and Positive and Negative Affect Schedule for Children. Additional measures of psychosocial well-being included Perceived Stress Scale and Inventory of Positive Psychological Attitudes. Secondary measures of self-regulatory skills included Resilience Scale, State Trait Anger Expression Inventory-2™, and Child Acceptance Mindfulness Measure. To assess feasibility, yoga students completed a program evaluation. Analyses of covariance were conducted between groups with baseline as the covariate. Results: Although PE-as-usual students showed decreases in primary outcomes, yoga students maintained or improved. Total mood disturbance improved in yoga students and worsened in controls (p .015), as did Profile of Mood States-Short Form (POMS-SF) Tension-Anxiety subscale (p .002). Although positive affect remained unchanged in both, negative affect significantly worsened in controls while improving in yoga students (p .006). Secondary outcomes were not significant. Students rated yoga fairly high, despite moderate attendance. Conclusions: Implementation was feasible and students generally found it beneficial. Although not causal due to small, uneven sample size, this preliminary study suggests preventive benefits in psychosocial well-being from Kripalu yoga during high school PE. These results are consistent with previously published studies of yoga in school settings.

**A Yoga Intervention for Music Performance Anxiety in Conservatory Students.** *Medical Problems of Performing Artists*. Stern, J., Khalsa, S. B., & Hofmann, S. (2012)

[https://www.researchgate.net/publication/230863792\\_A\\_Yoga\\_Intervention\\_for\\_Music\\_Performance\\_Anxiety\\_in\\_Conservatory\\_Students](https://www.researchgate.net/publication/230863792_A_Yoga_Intervention_for_Music_Performance_Anxiety_in_Conservatory_Students)

**ABSTRACT:** Music performance anxiety adversely affects a large minority of musicians. There is a need for additional treatment strategies, especially those that might be more acceptable to musicians than existing therapies. This pilot study examined the effectiveness of a 9-week yoga practice on reducing music performance anxiety in undergraduate and graduate music conservatory students, including both vocalists and instrumentalists. The intervention consisted of fourteen 60-minute yoga classes approximately twice a week and a brief daily home practice. Of the 24 students enrolled in the study, 17 attended the post-intervention assessment. Participants who completed the measures at both pre- and post-intervention assessments showed large decreases in music performance anxiety as well as in trait anxiety. Improvements were sustained at 7- to 14-month follow-up. No changes were observed in mood or in music performance anxiety as retrospectively perceived in group performance or practice settings. Participants generally provided positive comments about the program and its benefits. This study suggests that yoga is a promising intervention for MPA in conservatory students, and therefore warrants further research.

**Evaluation of the Mental Health Benefits of Yoga in a Secondary School: A Preliminary Randomized Controlled Trial.** *Journal of Behavioral Health Services and Research.* Khalsa S. B. Hickey-Schultz, L., Cohen, D., Steiner, N., & Cope, S. (2011)

<http://www.ncbi.nlm.nih.gov/pubmed/21647811> \*

ABSTRACT: The goal of this study was to evaluate potential mental health benefits of yoga for adolescents in secondary school. Students were randomly assigned to either regular physical education classes or to 11 weeks of yoga sessions based upon the Yoga Ed program over a single semester. Students completed baseline and end-program self-report measures of mood, anxiety, perceived stress, resilience, and other mental health variables. Independent evaluation of individual outcome measures revealed that yoga participants showed statistically significant differences over time relative to controls on measures of anger control and fatigue/inertia. Most outcome measures exhibited a pattern of worsening in the control group over time, whereas changes in the yoga group over time were either minimal or showed slight improvements. These preliminary results suggest that implementation of yoga is acceptable and feasible in a secondary school setting and has the potential of playing a protective or preventive role in maintaining mental health.

**Yoga Ameliorates Performance Anxiety and Mood Disturbance in Young Professional Musicians.** *Appl Psychophysiol Biofeedback.* Khalsa, S. B., Shorter, S., Cope, S., Wyshak, G., & Sklar, E. (2009)

<http://www.ncbi.nlm.nih.gov/pubmed/19657730> \*

ABSTRACT: Yoga and meditation can alleviate stress, anxiety, mood disturbance, and musculoskeletal problems, and can enhance cognitive and physical performance. Professional musicians experience high levels of stress, performance anxiety, and debilitating performance-related musculoskeletal disorders (PRMDs). The goal of this controlled study was to evaluate the benefits of yoga and meditation for musicians. Young adult professional musicians who volunteered to participate in a 2-month program of yoga and meditation were randomized to a yoga lifestyle intervention group (n = 15) or to a group practicing yoga and meditation only (n = 15). Additional musicians were recruited to a no-practice control group (n = 15). Both yoga groups attended three Kripalu Yoga or meditation classes each week. The yoga lifestyle group also experienced weekly group practice and discussion sessions as part of their more immersive treatment. All participants completed baseline and end-program self-report questionnaires that evaluated music performance anxiety, mood, PRMDs, perceived stress, and sleep quality; many participants later completed a 1-year follow up assessment using the same questionnaires. Both yoga groups showed a trend towards less music performance anxiety and significantly less general anxiety/tension, depression, and anger at end-program relative to controls, but showed no changes in PRMDs, stress, or sleep. Similar results in the two yoga groups, despite psychosocial differences in their interventions, suggest that the yoga and meditation techniques themselves may have mediated the improvements. Our results suggest that yoga and meditation techniques can reduce performance anxiety and mood disturbance in young professional musicians.



**Effects of a Yoga Lifestyle Intervention on Performance-Related Characteristics of Musicians: A Preliminary Study. *Med Sci Moni.* Khalsa, S.B., & Cope, S. (2006)**

<http://www.medscimonit.com/download/index/idArt/452854>

**ABSTRACT:** Background: Previous research has suggested that yoga and meditation practices are effective in stress management, alleviating anxiety and musculoskeletal problems and improving mood and cognitive and physical performance. Musicians experience a number of challenges in their profession including high levels of stress, performance anxiety and performance-related musculoskeletal conditions. Yoga and meditation techniques are therefore potentially useful practices for professional musicians. Material/Methods: Musicians enrolled in a prestigious 2-month summer fellowship program were invited to participate in a regular yoga and meditation program at a yoga center during the course of the program. The 10 participants in the yoga program completed baseline and end-program questionnaires evaluating performance-related musculoskeletal conditions, performance anxiety, mood and flow experience. Fellows not participating in the yoga program were recruited to serve as controls and completed the same assessments (N=8). Results: The yoga participants showed some improvements relative to control subjects on most measures, with the relative improvement in performance anxiety being the greatest. Conclusions: The results from this preliminary study suggest that yoga and meditation may be beneficial as a routine practice to reduce performance anxiety in musicians.

## Yoga and Front Line Professionals

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**Evaluation of the Psychological Benefits of a Yoga Program for Police Academy Recruits. *International Journal of Yoga Therapy.* Jeter, P., Cronin, S., & Khalsa, S.B. (2013)**

[https://www.researchgate.net/publication/256478725\\_Evaluation\\_of\\_the\\_benefits\\_of\\_a\\_kripalu\\_yoga\\_program\\_for\\_police\\_academy\\_trainees\\_a\\_pilot\\_study](https://www.researchgate.net/publication/256478725_Evaluation_of_the_benefits_of_a_kripalu_yoga_program_for_police_academy_trainees_a_pilot_study)

**ABSTRACT:** Law enforcement ranks as one of the most stressful occupations in the world. Yoga is a mind-body practice composed of postures, breathing, and meditation techniques, and is known for its beneficial effects on stress and mood disturbance. Objectives: This pilot study evaluated the effects of Kripalu yoga on perceived stress, mood, and mindfulness during police academy training. Method: Forty-two recruits participated in a 6-class yoga intervention. Participants completed the Profile of Mood States-Short Form, Perceived Stress Scale, and the Five Facet Mindfulness Questionnaire prior to and immediately following completion of the yoga program, as well as an exit survey. Results: Paired samples t-tests revealed significant postintervention changes in perceived stress and mood, reductions in tension and fatigue, and a trend toward reduced anger. Changes in mindfulness were not detected. The exit survey indicated perceived benefits of yoga for some participants. Conclusions: This preliminary study suggests that yoga may be beneficial for reducing stress, tension, and fatigue among police academy trainees. Future longitudinal randomized controlled trials are needed to evaluate its full potential as a permanent component of police academy training.

Moving Beyond Health to Flourishing: The Effects of Yoga Teacher Training. *The Scientific World Journal*. Conboy, L.A., Wilson, A., & Braun, T. (2010)

<http://www.hindawi.com/journals/tswj/2010/912064/abs/>

ABSTRACT: Research in the medical and psychological fields has primarily followed a “disease-focused” approach to health. Although there is growing research on the components and outcomes of well-being, very few studies have focused on traditional practices that can be used as interventions to encourage human flourishing. The current study was developed to address this research gap. We suggest one effective method of increasing psychological well-being, the practice of yoga, an age-old practice that has been said to produce physical and psychological health. In this observational study, we examined associations with participation in a 4-week yoga teacher training resident program. Measurement instruments were chosen to capture changes in psychosocial health and human flourishing. Measurements were taken before the start of the program, immediately after the program, and 3 months postprogram. As expected, in this healthy population, the human flourishing scales showed more change than the psychosocial health scales. For example, in this healthy sample, there were no significant changes in perceived social support, quality of life, or self-efficacy from baseline to the 3-month follow-up. However, optimism, a positive psychology research measure, improved from baseline to follow-up. The mindfulness subscales of observation, awareness, and nonreactivity all improved following the training, suggesting that one benefit of yoga practice is a more refined ability to attend to one’s inner experience. This study adds to the growing literature focusing on interventions that move beyond relieving pathology to those that produce optimal functioning and human thriving.

## Yoga and the Brain

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**Greater Widespread Functional Connectivity of the Caudate in Older Adults Who Practice Kripalu Yoga and Vipassana Meditation than in Controls.** *Frontiers in Human Neuroscience*. Gard. T., Dixit, R., Hölzel, B., Dickerson, B., & Lazar, S. (2015)

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4360708/>

ABSTRACT: There has been a growing interest in understanding how contemplative practices affect brain functional organization. However, most studies have restricted their exploration to predefined networks. Furthermore, scientific comparisons of different contemplative traditions are largely lacking. Here we explored differences in whole brain resting state functional connectivity between experienced yoga practitioners, experienced meditators, and matched controls. Analyses were repeated in an independent sample of experienced meditators and matched controls. Analyses utilizing Network-Based Statistics (Zalesky et al., 2010) revealed difference components for yoga practitioners > controls and meditators > controls in which the right caudate was a central node. Follow up analyses revealed that yoga practitioners and meditators had significantly greater degree centrality in the caudate than controls. This greater degree centrality was not driven by single connections but by greater connectivity between the caudate and numerous brain regions. Findings of greater caudate connectivity in meditators than in controls was replicated in an independent dataset. These findings suggest that yoga and meditation practitioners have stronger functional connectivity within basal ganglia cortico-thalamic feedback loops than non-practitioners. Although we could not provide evidence for its mechanistic role, this greater connectivity might be related to the often reported effects of meditation and yoga on behavioral flexibility, mental health, and well-being

**Fluid Intelligence and Brain Functional Organization in Aging Yoga and Meditation Practitioners.** *Frontiers in Aging Neuroscience*, Gard. T., Taquet, M., Dixit, R., Hölzel, B., de Montjoye, Y.A., Brach, N., Salat, D., Dickerson, B., Gray, J., & Lazar, S. (2014)

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4001007/>

ABSTRACT: Numerous studies have documented the normal age-related decline of neural structure, function, and cognitive performance. Preliminary evidence suggests that meditation may reduce decline in specific cognitive domains and in brain structure. Here we extended this research by investigating the relation between age and fluid intelligence and resting state brain functional network architecture using graph theory, in middle-aged yoga and meditation practitioners, and matched controls. Fluid intelligence declined slower in yoga practitioners and meditators combined than in controls. Resting state functional networks of yoga practitioners and meditators combined were more integrated and more resilient to damage than those of controls. Furthermore, mindfulness was positively correlated with fluid intelligence, resilience, and global network efficiency. These findings reveal the possibility to increase resilience and to slow the decline of fluid intelligence and brain functional architecture and suggest that mindfulness plays a mechanistic role in this preservation.

## Yoga for Diverse and Underserved Populations

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**Yoga for Military Service Personnel With PTSD: A Single Arm Study.** *Psychological Trauma: Theory, Research, Practice, and Policy*. Johnston, J., Minami, T., Greenwald, D., Li, C., Reinhardt, K., & Khalsa, S. B. (2015)

<http://www.ncbi.nlm.nih.gov/pubmed/26010108>\*

**ABSTRACT:** This study evaluated the effects of yoga on posttraumatic stress disorder (PTSD) symptoms, resilience, and mindfulness in military personnel. Participants completing the yoga intervention were 12 current or former military personnel who met the *Diagnostic and Statistical Manual for Mental Disorders-Fourth Edition-Text Revision (DSM-IV-TR)* diagnostic criteria for PTSD. Results were also benchmarked against other military intervention studies of PTSD using the Clinician Administered PTSD Scale (CAPS; Blake et al., 2000) as an outcome measure. Results of within-subject analyses supported the study's primary hypothesis that yoga would reduce PTSD symptoms ( $d = 0.768$ ;  $t = 2.822$ ;  $p = .009$ ) but did not support the hypothesis that yoga would significantly increase mindfulness ( $d = 0.392$ ;  $t = 0.9500$ ;  $p = .181$ ) and resilience ( $d = 0.270$ ;  $t = 1.220$ ;  $p = .124$ ) in this population. Benchmarking results indicated that, as compared with the aggregated treatment benchmark ( $d = 1.074$ ) obtained from published clinical trials, the current study's treatment effect ( $d = 0.768$ ) was visibly lower, and compared with the waitlist control benchmark ( $d = 0.156$ ), the treatment effect in the current study was visibly higher.

**Psychological Well-Being, Health Behaviors, and Weight Loss Among Participants in a Residential, Yoga-Based Weight Loss Program.** *International Journal of Yoga Therapy*. Braun, T., Park, C., & Conboy, L.A. (2012)

[https://www.researchgate.net/publication/232256364\\_Psychological\\_well-being\\_health\\_behaviors\\_and\\_weight\\_loss\\_among\\_participants\\_in\\_a\\_residential\\_Kripalu\\_yoga-based\\_weight\\_loss\\_program](https://www.researchgate.net/publication/232256364_Psychological_well-being_health_behaviors_and_weight_loss_among_participants_in_a_residential_Kripalu_yoga-based_weight_loss_program)

**ABSTRACT:** The increasing prevalence of overweight and obesity in humans is a growing public health concern in the United States. Concomitants include poor health behaviors and reduced psychological well-being. Preliminary evidence suggests yoga and treatment paradigms incorporating mindfulness, self-compassion (SC), acceptance, nondieting, and intuitive eating may improve these ancillary correlates, which may promote long-term weight loss. **Methods:** We explored the impact of a 5-day residential weight loss program, which was multifaceted and based on Kripalu yoga, on health behaviors, weight loss, and psychological well-being in overweight/obese individuals. Thirty-seven overweight/obese program participants (age 32-65, BMI>25) completed validated mindfulness, SC, lifestyle behavior, and mood questionnaires at baseline, postprogram, and 3-month follow-up and reported their weight 1 year after program completion. **Results:** Significant improvements in nutrition behaviors, SC mindfulness, stress management, and spiritual growth were observed immediately postprogram ( $n=21$ , 84% retention), which medium to large effect sizes. At 3-month follow-up ( $n=18$ , 49% retention), most changes persisted. Physical activity and mood disturbance had improved significantly postprogram but failed to reach significance at 3-month follow-up. Self-report weight loss at 1 year ( $n=19$ , 51% retention) was significant. **Conclusion:** These findings suggest a Kripalu yoga-based, residential weight loss program may foster psychological well-being, improved nutrition behaviors, and weight loss. Given the exploratory nature of this investigation, more rigorous work in this area is warranted.

Perceived Benefits of Kripalu Yoga Classes in Diverse and Underserved Populations. *International Journal of Yoga Therapy*. Wilson, A., Marchesiello, K., & Khalsa, S.B. (2008)

<http://iaytjournals.org/doi/abs/10.17761/ijyt.18.1.q5152q8222549x18?journalCode=ijyt>\*

ABSTRACT: Objective: To determine if diverse and underserved populations report benefit from Yoga practices and report an intention to continue with Yoga, meditation, or breathing practices. Design: This was a retrospective study using archival data from exit questionnaires acquired at the end of Yoga programs serving diverse populations. Qualitative data was also collected from the Yoga teachers. Setting: Free Kripalu Yoga classes offered to diverse and underserved/underprivileged populations (e.g., minority groups, the elderly, gay populations), as part of the Teaching for Diversity (TFD) program through the Kripalu Center for Yoga and Health (KCYH). Participants: 220 participants, ranging in age from adolescence through old age. Measures: Nine questions about the perceived benefits and usefulness of Yoga practices in everyday life were administered to participants on the last day of class. Qualitative data was collected from teachers regarding their experience teaching underserved populations. Results: Of the 220 respondents, 89% reported that the Yoga class left them with a feeling of overall wellness, and 83% found the practices helpful. 98% reported that they would recommend this Yoga class to others. Participants found the individual Yoga components of the breathing, Yoga postures, and meditation practices effective and said they were useful in their daily life. Pairwise t-test comparisons of average scores between these three practices indicated that participants were more likely to rate breathing useful as compared to either the postures or meditation ( $p < 0.01$ ). Conclusion: Diverse and underserved populations report benefit from and interest in Yoga, meditation, and breathing practices.

Yoga as a Therapeutic Intervention: A Bibliometric Analysis of Published Research Studies. *Indian Journal of Physiology & Pharmacology*. Khalsa, S.B. (2004)

[https://www.researchgate.net/publication/8083778\\_Yoga\\_as\\_a\\_therapeutic\\_intervention\\_A\\_bibliometric\\_analysis\\_of\\_published\\_research\\_studies](https://www.researchgate.net/publication/8083778_Yoga_as_a_therapeutic_intervention_A_bibliometric_analysis_of_published_research_studies)

ABSTRACT: Although yoga is historically a spiritual discipline, it has also been used clinically as a therapeutic intervention. A bibliometric analysis on the biomedical journal literature involving research on the clinical application of yoga has revealed an increase in publication frequency over the past 3 decades with a substantial and growing use of randomized controlled trials. Types of medical conditions have included psychopathological (e.g. depression, anxiety), cardiovascular (e.g. hypertension, heart disease), respiratory (e.g. asthma), diabetes and a variety of others. A majority of this research has been conducted by Indian investigators and published in Indian journals, particularly yoga specialty journals, although recent trends indicate increasing contributions from investigators in the U.S. and England. Yoga therapy is a relatively novel and emerging clinical discipline within the broad category of mind-body medicine, whose growth is consistent with the burgeoning popularity of yoga in the West and the increasing worldwide use of alternative medicine.