

Role of Yoga in the Enhancement of Cardiac Autonomic Function

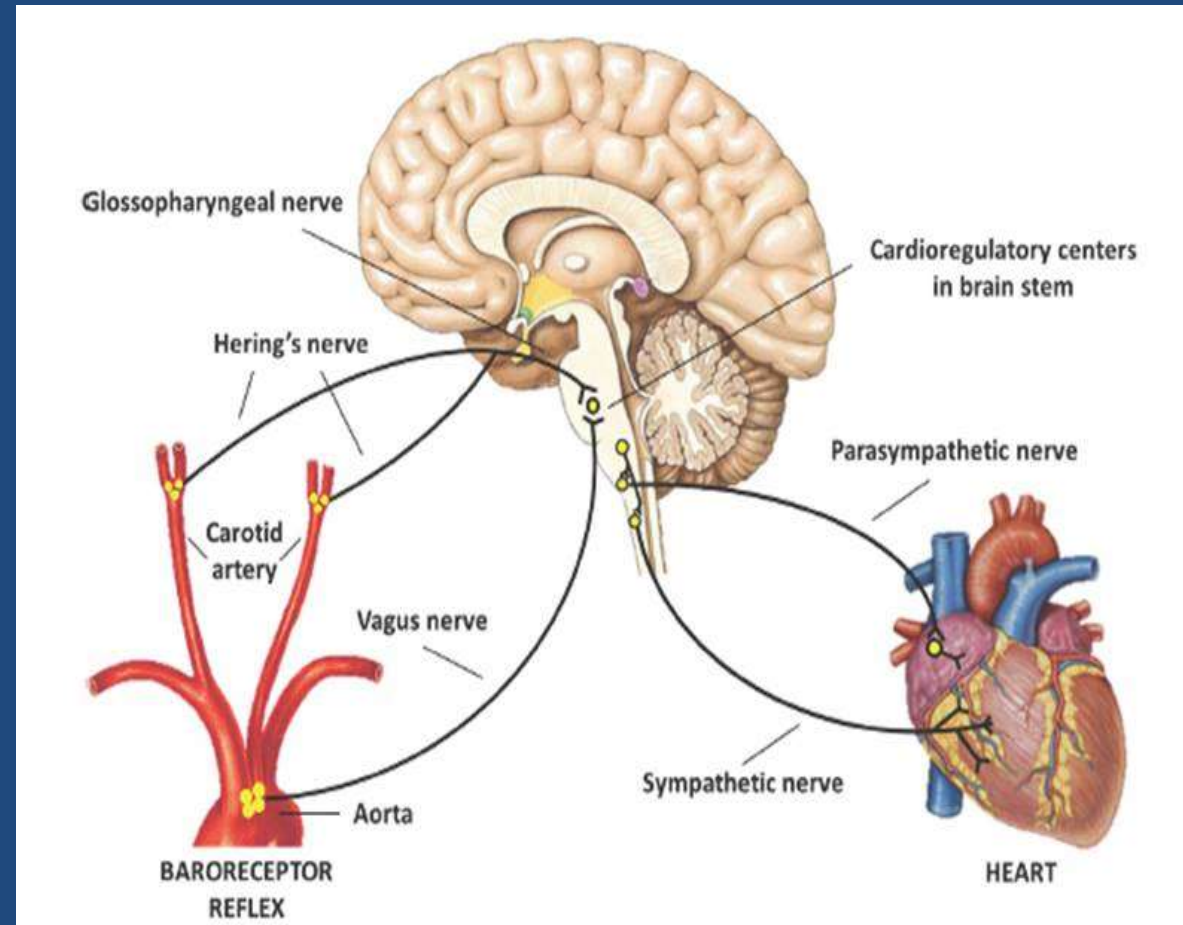


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Cardiac Autonomic Function

- ◇ Regulation of cardiac function by sympathetic and parasympathetic innervations.
 - ◇ Parasympathetic NS down- regulates
 - ◇ Sympathetic NS up-regulates
- ◇ Both together helps in normal cardiac functioning

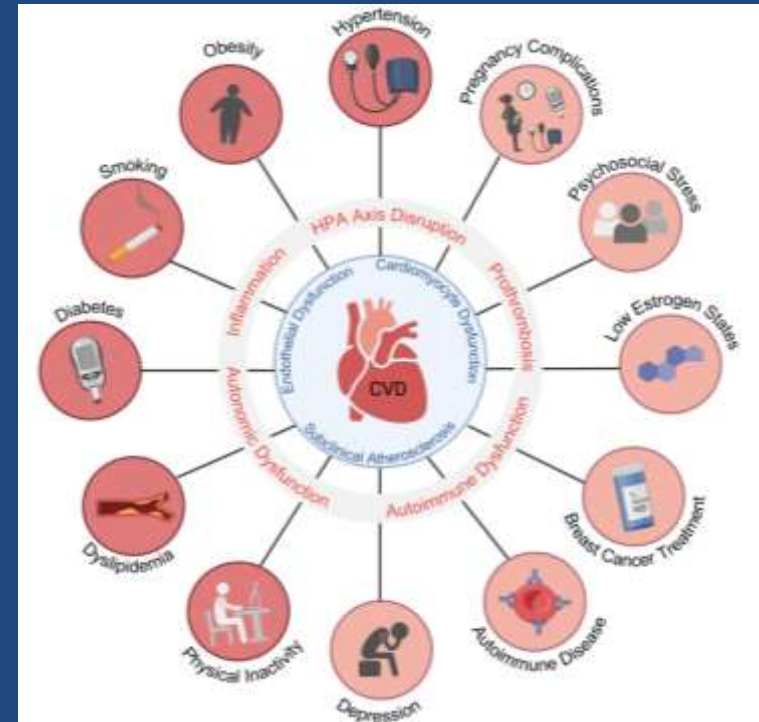


Cardiac Autonomic Dysfunction & CVD risk factors

- ◇ Increased sympathetic activity and decrease in parasympathetic tone
- ◇ Consequences of cardiac autonomic imbalance or dysfunction
 - ◇ Elevated blood pressure
 - ◇ Increased heart rate
 - ◇ Increased risk of cardiovascular disease and sudden cardiac death
 - ◇ Increased risk of mortality
 - ◇ Reduced exercise tolerance
 - ◇ Cardiac arrhythmias
 - ◇ Stroke

Associated with CVD risk factors

- ◇ Hypertension
- ◇ Obesity
- ◇ Diabetes mellitus
- ◇ Metabolic syndrome
- ◇ Hypothyroidism
- ◇ Chronic stress



Yoga

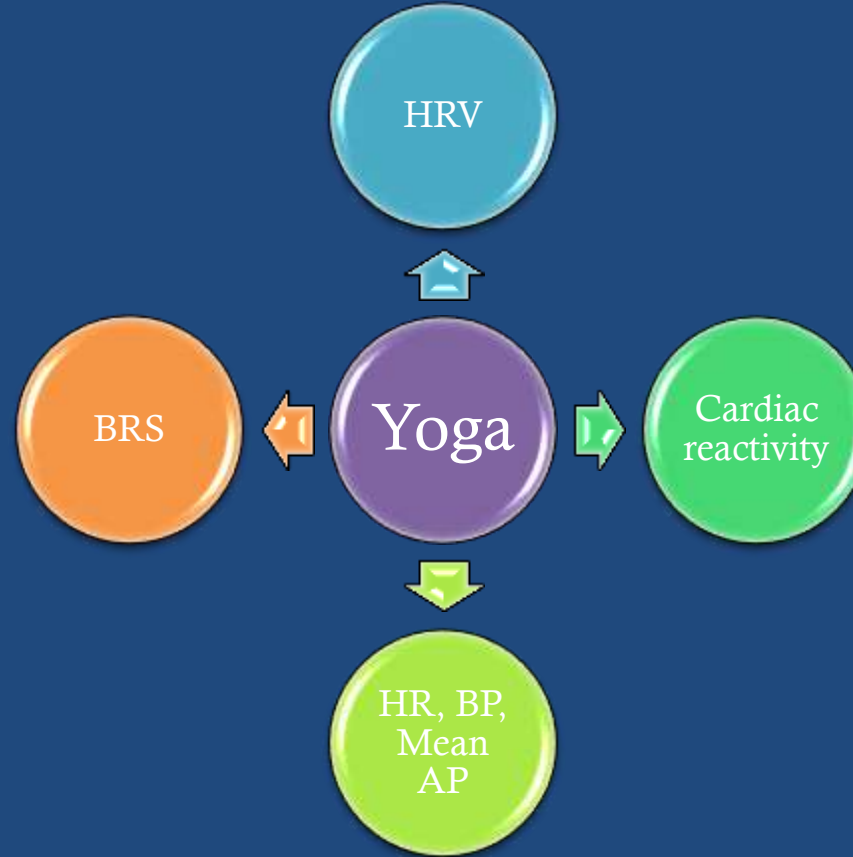
- ◇ A discipline of mind, body and behaviour
- ◇ It encompass practice of
 - ◇ Truthfulness
 - ◇ Non-violence
 - ◇ Sharing
 - ◇ Self-control
 - ◇ Yoga postures
 - ◇ Breathing techniques
 - ◇ Meditation and
 - ◇ Prayer



Health benefits of yoga

Circulatory System	Endocrine System	Musculoskeletal System	Nervous system	Mind	Digestive System	Reproductive System
Improves •HR, BP, CO •BRS, HRV	Reduce •HPA-Axis over activity •Cortisols •Epinephrine, nor-epinephrine •insulin levels •Serotonin, melatonin	Improves •Muscle strength and flexibility •Balance and gate	•Sympatho-vagal balance •GABA levels •Brain wave coherence •Cogitative abilities and memory	Improve mood, self-esteem, confidence •Reduce anxiety, anger, depression	Improves digestion, constipation,	•Improves fertility, sperm count and motility •Reduce DNA damage, improve estrogens and progesterone levels in females

Yoga and Cardiac Autonomic Functions



Yoga and HRV

- ◇ Heart Rate Variability is beat to beat variation in the heart rate
- ◇ Widely studied cardiac autonomic function marker
- ◇ Assess sympathetic activity, parasympathetic activity and sympatho-vagal balance
 - ◇ **Frequency Domain**
 - ◇ High frequency
 - ◇ Low frequency
 - ◇ Very low frequency
 - ◇ **Time domain**
 - ◇ RMSSD
 - ◇ PNN50

Yoga in Hypertension

- 40 yoga and 40 in control group
- The yoga group received 12 weeks of yoga
- There was a significant decrease in the resting systolic pressure (SP), diastolic pressure (DP), rate pressure product (RPP), and mean arterial pressure (MAP) in the yoga group.
- There was no significant change in the control group.
- HRV - High frequency (HF) significantly increase and low frequency decrease in the yoga group at the end of the 12-week yoga therapy.

Randomized controlled trial of 12-week yoga therapy as lifestyle intervention in patients of essential hypertension and cardiac autonomic function tests

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Bhramari Pranayama

- ◇ 520 healthy adolescents
- ◇ 260 received Bhramari Pranyama (5min/day) 5 days/week for six months
- ◇ After 6 months of yoga breathing, the time domain parameters of short term HRV showed significant ($P < 0.05$) improvement towards the parasympathetic domain.
- ◇ Frequency domain parameters also showed the same direction of changes.
- ◇ In contrast, control group subjects showed a trend towards a sympathetic domain

(Kuppusamy et al 2020)

Original Article

Effects of yoga breathing practice on heart rate variability in healthy adolescents: a randomized controlled trial

[Maheshkumar Kuppusamy](#)^a  , [Dilara Kamaldeen](#)^b,
[Ravishankar Pitani](#)^c, [Julius Amaldas](#)^d, [Padmavathi Ramasamy](#)^b,
[Poonguzhali Shanmugam](#)^a, [Venugopal Vijayakumar](#)^a

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Systematic review

- ◇ On 12 RCTs with 2358 participants
- ◇ yoga can affect cardiac autonomic regulation with increased HRV and vagal dominance during yoga practices.
- ◇ Regular yoga practitioners were also found to have increased vagal tone at rest compared to non-yoga practitioners.

(Anupama et al, 2016)

The screenshot shows the article page for 'Yoga and heart rate variability: A comprehensive review of the literature' in the International Journal of Yoga (IJY). The page includes the journal logo, navigation links (Home, Current issue, Instructions, Submit article), publication details (Int. J. Yoga, 2016 Jul-Dec; 9(2): 97-113, doi: 10.4103/0973-6131.183712), and identifiers (PMCID: PMC4959333, PMID: 27512317). The authors listed are Anupama Tyagi and Marc Cohen. There are links for Author information, Copyright and License information, and PMC Disclaimer. The abstract section is titled 'Abstract' and contains the following text: 'Heart rate variability (HRV) has been used as a proxy for health and fitness and indicator of autonomic regulation and therefore, appears well placed to assess the changes occurring with mind.-body practices that facilitate autonomic balance. While many studies suggest that yoga HRV, such studies have not been systematically reviewed. We aimed to systematically published papers that report on yoga practices and HRV. A comprehensive search of multiple databases was conducted and all studies that reported a measure of HRV associated with'. A 'Get citation' button is visible at the bottom left of the abstract area.

Yoga and HRV

- ◇ Frequency Domain
 - ◇ Yoga increases HF
 - ◇ Reduce LF and LF/HF ratio
- ◇ Time Domain
 - ◇ Increase RMSSD
 - ◇ Increase pNN50

Yoga reduce sympathetic activity and enhance vagal tone

[Front Psychol.](#) 2021; 12: 731645. PMCID: PMC8678535
Published online 2021 Dec 3. doi: [10.3389/fpsyg.2021.731645](https://doi.org/10.3389/fpsyg.2021.731645) PMID: [34925139](https://pubmed.ncbi.nlm.nih.gov/34925139/)

Can Yoga Boost Access to the Bodily and Emotional Self? Changes in Heart Rate Variability and in Affective Evaluation Before, During and After a Single Session of Yoga Exercise With and Without Instructions of Controlled Breathing and Mindful Body Awareness in Young Healthy Women

[Cornelia Herbert](#)*

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Associated Data

- [Supplementary Materials](#)
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Abstract

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Exercise is indispensable for a healthy lifestyle. Yoga exercise can have positive effects on well-being and on cardiac autonomic activity making it an ideal intervention for improving mind-body interactions and resilience to physical and mental stressors. Emotions trigger especially strong bodily and affective-cognitive responses because of their social relevance for the self and their biological relevance of mobilizing the organism for action. This study investigates whether changes in emotion processing related to self-other referential processing and changes in cardiac autonomic activity, reflected by heart rate variability (HRV), occur immediately after already a single session of yoga exercise when yoga postures are practiced with or without breathing- and mindful body

Yoga and Cardiac Reactivity to stressor

- ◆ Heightened Cardiac reactivity to stress and delayed recovery is associated with increased risk of cardiovascular disease and inflammation.
- ◆ Cardiac autonomic function is an independent determinant of cardiac reactivity to stress
- ◆ Yoga practice is associated with faster recovery post exposure to laboratory stressors.

Single session of Yoga & Stress reactivity

- ◇ 21 RCT studies with 2574 participants
- ◇ HR, HRV and Blood pressure were most commonly assessed cardiac measures
- ◇ 71% of studies showed significant improvement in physiological measures
- ◇ Most of these studies reported increase in HF and decrease in HR

(Gandhar et al, 2023)



The screenshot shows the top portion of a research article page. At the top, the journal title 'STRESS & HEALTH' is displayed in a large, bold, sans-serif font, with 'STRESS' in red and '& HEALTH' in white on a blue background. Below the title, the article type 'REVIEW ARTICLE' is shown, followed by 'Open Access' and Creative Commons icons. The main title of the article is 'Effect of a single session of yoga and meditation on stress reactivity: A systematic review'. The authors listed are Gandhar V. Mandlik, George Siopis, Binh Nguyen, Ding Ding, and Kate M. Edwards. The publication date is 'First published: 11 October 2023' and the DOI is 'https://doi.org/10.1002/smi.3324'. Navigation options include 'SECTIONS', 'PDF', 'TOOLS', and 'SHARE'. The 'Abstract' section begins with the text: 'This systematic review synthesises the evidence for the effectiveness of a single session of yoga or its components including meditation and breathing techniques in reducing acute stress reactivity in healthy adults. Following the PRISMA guidelines, we searched Medline, EMBASE, Cochrane, CINAHL, and PsycINFO on 30th July 2023 for randomised controlled or crossover trials of yoga components and reporting physiological and/or psychological outcome measure(s) related to stress reactivity. Risk of bias (ROB) was assessed using the Cochrane ROB 2 tool. Data were synthesised narratively. Twenty-one out of 28 eligible studies (n = 2574) relating to 31 interventions (meditation [n = 22], breathing [n = 4] and yoga [n = 5]) reported outcomes in favour of the intervention. Stress reactivity was reported to be reduced by 71% of studies measuring physiological outcomes and 65% of studies measuring psychological outcomes. These studies show that a single session of yoga components is effective in reducing acute stress reactivity in adults and could be recommended for stress management. Future studies with larger

Yoga breathing helps in faster recovery

- ◇ N= 75
- ◇ Cognitive stress – continuous performance task and Go no go task
 - ◇ Slow breathing at the rate of 6 bpm found to be effective in improving faster recovery compared to mindfulness body scan and sitting quite following 2 cognitive and 1 emotional task

The screenshot shows the front page of a research article. At the top left is the MIR logo. The article title is "Exploring the Effects of a Brief Biofeedback Breathing Session Delivered Through the BioBase App in Facilitating Employee Stress Recovery: Randomized Experimental Study". The authors listed are Chloë Chubb, David Potts, Steve Patten, Daniel Moxon, MSc, PhD, and Mark Croxall. The article is published in MIR, 2020, Oct, 8(10), e19412. The page includes a sidebar with social media icons and a 'Resources' section with buttons for 'Similar articles', 'Cited by other articles', and 'Links to NCBI Database'.

Breathing with muscle contraction

- ◆ Slow Breathing with upper-limb muscle contraction reported induce high parasympathetic activation during cognitive task compared to simple breathing or only muscle contraction.

[Stress Health](#), Author manuscript; available in PMC 2022 Jan 13. PMCID: PMC8758201
Published in final edited form as: NIHMSID: NIHMS1040478
[Stress Health](#), 2019 Oct; 35(4): 542-548. PMID: [31347763](#)
Published online 2019 Sep 5. doi: [10.1002/smi.2887](#)

Author Manuscript

Understanding mind-body disciplines: A pilot study of paced breathing and dynamic muscle contraction on autonomic nervous system reactivity

[Michael S. Chin](#)^{1,2} and [Stefanos N. Kales](#)^{3,4}

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The publisher's final edited version of this article is available at [Stress Health](#)

Abstract

Go to: ▶

Mind-body disciplines such as yoga, Tai Chi, and Qigong have been demonstrated to activate the parasympathetic nervous system, but it remains unclear how these practices achieve these results, whether by breathing, movement, or some combination. This pilot study establishes a model to examine the individual and combined effects of paced breathing and rhythmic skeletal muscle contraction on the activation of the parasympathetic system during a cognitive stressor. Male participants were randomly assigned to one of four preconditioning groups: (a) paced breathing alone, (b) alternating upper extremity muscle contractions, (c) paced breathing synchronized with

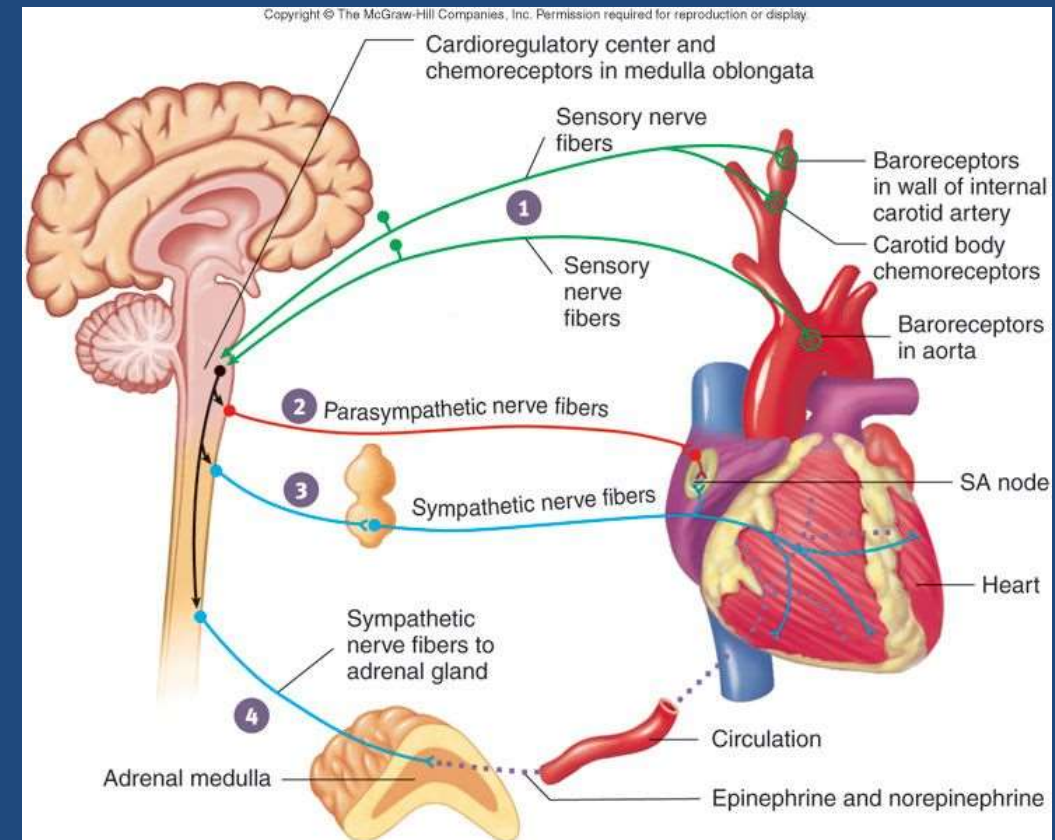
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Yoga and Baroreflex Sensitivity

- ◇ Baroreflex Sensitivity: Stretch receptors in the major blood vessels assess variation the blood pressure and sends messages to cardiac centres in the brain stem
- ◇ Brain brings down the blood pressure to normalcy by activating parasympathetic activity

Yoga and Baroreflex Sensitivity

- ◇ Yoga increase baroreflex sensitivity among health population
- ◇ It also increase baroreflex sensitivity among hypertensive and patients with congestive cardiac failure.
- ◇ BP buffering and cardioprotection



Slow Breathing

- ◇ 5 healthy individual; Baroreflex sensitive measured during spontaneous breathing, slow breathing with 6 bpm, and breathing at 15 bpm
- ◇ During slow breathing baroreflex sensitivity was significantly greater compared to other conditions

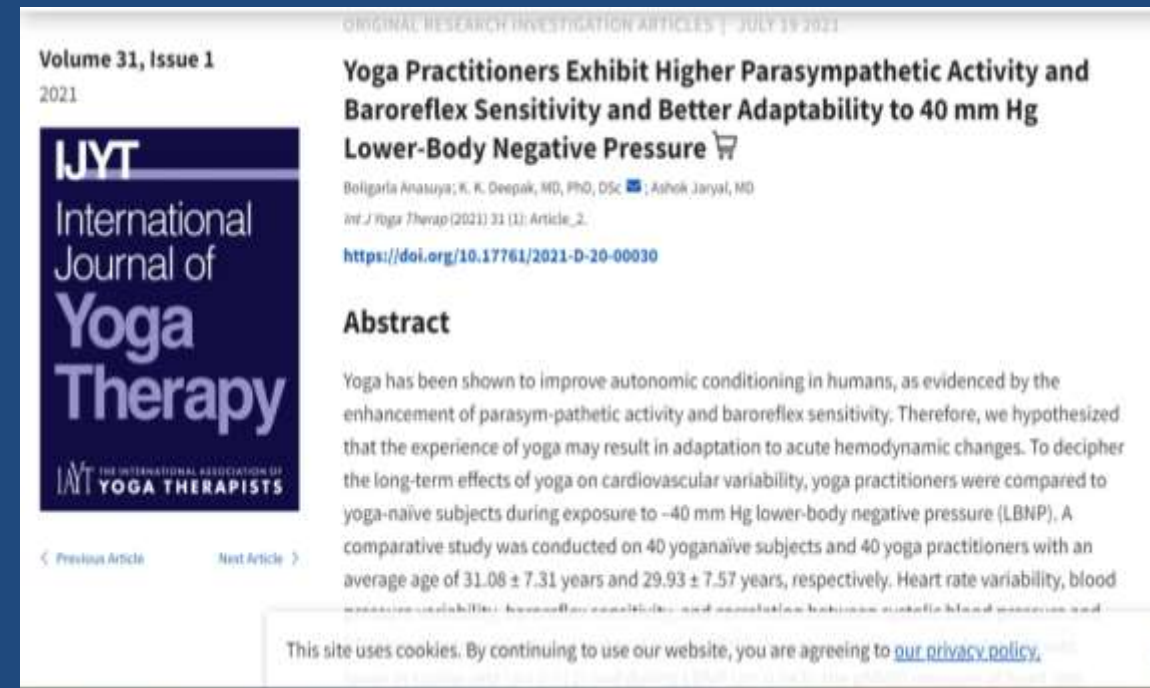
(Barnadi et al, 2001)



The image shows a screenshot of a journal article page from the Journal of Hypertension. The page features a navigation bar with links for 'Articles & Issues', 'For Authors', 'Journal Info', 'Latest Articles', 'Podcasts', and 'Twitter'. The main content area displays the article title 'Slow breathing reduces chemoreflex response to hypoxia and hypercapnia, and increases baroreflex sensitivity' under the heading 'ORIGINAL PAPERS: NEURAL MECHANISMS'. The authors listed are Bernardi, Luciano^a; Gabutti, Alessandra^a; Porta, Cesare^a; Spicuzza, Lucia^b. The article is cited as 'Journal of Hypertension 19(12):p 2221-2229, December 2001.' On the left side of the article, there are icons for 'Cite', 'Share', 'Favorites', and a Creative Commons license icon.

Yoga and Baroreflex sensitivity

- ◇ 40 yoga naive and 40 yoga practitioners
- ◇ Heart rate variability, blood pressure variability, baroreflex sensitivity, and correlation between systolic blood pressure and RR interval were evaluated at rest and during LBNP
- ◇ Yoga practitioners had lower HR and higher baroreflex sensitivity during res and in lower body negative pressure
- ◇ The yoga practitioners exhibited higher parasympathetic activity and baroreflex sensitivity with lower systolic blood pressure variability, indicating better adaptability to LBNP compared to the yoga-naïve group.



ORIGINAL RESEARCH INVESTIGATION ARTICLES | JULY 19 2021

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Therapy
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YOGA THERAPISTS

Yoga Practitioners Exhibit Higher Parasympathetic Activity and Baroreflex Sensitivity and Better Adaptability to 40 mm Hg Lower-Body Negative Pressure

Boligarla Anasuya; K. K. Deepak, MD, PhD, DSc; Ashok Janyal, MD
Int J Yoga Therap (2021) 31 (1): Article 2.
<https://doi.org/10.17761/2021-D-20-00030>

Abstract

Yoga has been shown to improve autonomic conditioning in humans, as evidenced by the enhancement of parasympathetic activity and baroreflex sensitivity. Therefore, we hypothesized that the experience of yoga may result in adaptation to acute hemodynamic changes. To decipher the long-term effects of yoga on cardiovascular variability, yoga practitioners were compared to yoga-naïve subjects during exposure to -40 mm Hg lower-body negative pressure (LBNP). A comparative study was conducted on 40 yoga-naïve subjects and 40 yoga practitioners with an average age of 31.08 ± 7.31 years and 29.93 ± 7.57 years, respectively. Heart rate variability, blood pressure variability, baroreflex sensitivity, and correlation between systolic blood pressure and

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Yoga in Pregnancy

- 49 qualifying controlled trials (56 interventions).
- On average, the 3517 trial participants were middle-aged (49.2 ± 19.5 years), overweight (27.9 ± 3.6 kg/m²) adults with high BP (systolic BP, 129.3 ± 13.3 mm Hg; diastolic BP, 80.7 ± 8.4 mm Hg)
- On average, yoga elicited moderate reductions in systolic BP (weighted mean effect size, -0.47 ; 95% CI, -0.62 - 0.32 , -5.0 mm Hg) and diastolic BP (weighted mean effect size, -0.47 ; 95% CI, -0.61 to -0.32 ; -3.9 mm Hg) compared with controls ($P < .001$ for both systolic BP and diastolic BP).
- when yoga was practiced 3 sessions per week among samples with hypertension, yoga interventions that included breathing techniques and meditation/mental relaxation elicited BP reductions of 11/6 mm Hg compared with those that did not (ie, 6/3 mm Hg).

Randomized Controlled Trial > Sci Rep. 2022 Jul 12;12(1):11732.

doi: 10.1038/s41598-022-15216-4.

Effects of yoga on cardiometabolic risks and fetomaternal outcomes are associated with serum nitric oxide in gestational hypertension: a randomized control trial

Kuzhanthaivelu Karthiga¹, Gopal Krushna Pal², Papa Dasari³, Nivedita Nanda⁴, Subramanian Velkumary¹, Palanivel Chinnakali⁵, Manoharan Renugasundari¹, K T Harichandrakumar⁶

Affiliations & expand


Yoga in MI


- ◇ Yoga group received 13 sessions of yoga over 12 weeks in addition to standard care
- ◇ Control group received educational sessions in addition to standard care for same duration
- ◇ BRS increased significantly in yoga group and declines in the standard care
- ◇ α LF and α HF between groups for SBP. The α LF and α HF of systolic BP increased in the yoga group while a decline was noted in the standard care group at 13th week

Home > Applied Psychophysiology and Biofeedback > Article

Effect of Yoga Based Cardiac Rehabilitation on Blood Pressure Variability and Baroreflex Sensitivity: RCT in Patients Post MI

Published: 01 November 2022
Volume 48, pages 1–15, (2023) [Cite this article](#)

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Edmin Christa, Prachi Srivastava, Dinu S. Chandran, Ashok Kumar Jaryal, Raj Kumar Yadav, Ambuj Roy & Kishore Kumar Deepak 

Summary

- ◇ Cardiac Autonomic Function is a predictor of cardiac morbidity and mortality
- ◇ Yoga is an effective intervention in improving cardiac autonomic function
- ◇ Simple yogic techniques such as slow breathing, meditation and yoga session influence cardiac autonomic function instantly
- ◇ Long term practice of yoga enhance vagal modulation

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Thank You