

Healing the Heart: Can Yoga be the Missing Piece that Completes the Puzzle in Modern Medicine?

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Abstract

Over the years, research has revealed that yoga is beneficial in stress reduction, weight loss, and increased fitness. Yoga has also been found to be valuable in the treatment and prevention of numerous medical conditions including diabetes, obesity, depression and cardiovascular disease. In fact, yoga fosters a lifestyle that promotes better heart function, through a holistic health approach developing the mind-body relationship. Recently, studies have confirmed that the regular practice of yoga has been beneficial in the treatment and prevention of cardiovascular disease and conditions such as hypertension, coronary artery disease, and some arrhythmias. In light of these findings, yoga has gained popularity in the medical field, including with physicians that specialize in the fields of cardiology and neurology. Improving our understanding of the interactions between the brain and the cardiovascular system has paved a way in unlocking the connection of mind body control. This article summarizes the current role of yoga in treating cardiovascular conditions.

Keywords: Weight loss; Hypertension; Coronary artery disease

Introduction

Cardiovascular Diseases (CVD) remain one of the leading causes of mortality across the world [1]. Recent data suggest that unfavorable lifestyle trends promoting weight gain are leading to an increase in CVD risk factors such as diabetes mellitus, hypertension, hypercholesterolemia, obesity, mental stress and metabolic syndrome [1].

It has been shown that regular practice of yoga can have a significant positive effect on general as well as cardiovascular health of individuals. Numerous studies have established the health benefit of yoga, primarily on hypertension, hypercholesterolemia and obesity which are the leading risk factors associated with cardiovascular diseases [2-6]. Practice of the different arms of yoga: *asana*, *pranayama* and *meditation*, alone or in combination, have been shown to boost immunity and decrease stress, reduce obesity and hence have benefitted patients with CVD [2]. Yoga has been described in ancient Indian texts to balance sympathetic and parasympathetic nervous system imbalances which have been proven to maintain optimal health [7].

The autonomic nervous system (ANS or visceral nervous system) is the part of the peripheral nervous system that acts as a regulatory enterprise functioning largely below the level of consciousness, and controls visceral functions. The ANS affects heart rate, blood pressure (amongst other heart related parameters), digestion, respiration rate, salivation, perspiration, adjustment of vision, micturition (urination), and sexual arousal. It has been recognized for upward of 50 years in the field of medicine with studies demonstrating that the alteration of autonomic nervous systems could not only alter heart rate and blood pressure but also affect individual muscle cells of the heart [8,9].

Systemic Inflammation & Autonomic Imbalances in Cardiovascular Disease

Chronic systemic inflammation has been linked to increased incidence of cardiovascular disease as well as an increased incidence of arrhythmias as evidenced by increased prevalence of both in subjects with chronic elevation of the inflammatory markers. Elevated levels of inflammatory markers like IL-6, IL-8 and CRP as seen in patients with chronic inflammatory states have been associated with increased and accelerated atherosclerosis and increased CVD mortality [10,11].

They have also been associated with endothelial dysfunction, increased cholesterol levels and high sympathetic tone. Arrhythmias like atrial fibrillation are also associated with increased levels of these inflammatory markers and low heart rate variability. Recent data shows that regular practice of yoga can considerably decrease the levels of these markers and has decreased the incidence of atrial fibrillation.

ANS anatomically and physiologically is divided into the sympathetic nervous system (SNS) and the parasympathetic nervous system (PSN). The levels of activity are generally inversely related; for example, if the SNS is over active, the PNS is usually suppressed. The ANS exerts its effects by the use of chemical molecules, also called neurotransmitting hormones, releasing these hormones directly in the blood stream. The effects of the ANS are critical as they provide for defensive mechanisms in all living species such as the fight or flight response that is mediated by activation of the sympathetic nervous system.

The fight or flight response is an old ancestral human response to survival. The body handles this response in part by the release of stress hormones (adrenaline and cortisol) and is responsible for a series of changes in the body i.e. raising blood pressure, heart rate, and blood sugar levels. These changes help a person deal with a crisis situation. Over years, research has shown that various manifestations of heart disease, such as, heart failure, disturbance of the heart rhythm (arrhythmias), blood pressure variations, and symptoms like syncope, all to a certain degree have an imbalance between the sympathetic and parasympathetic nervous system. This same response is also activated in

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patients with heart failure and after a heart attack. The PNS, as opposed to SNS, tends to slow the heart and lower blood pressure, allowing recovery after a stressful event. Blood flow that was diverted away from the non-essential organs (intestines and reproductive organs) returns. This is more of a restorative phase and may be termed as "rest and digest".

Recent evidence suggests that both sympathetic and parasympathetic neural input to the heart influence a number of parameters affecting the electrical system and the blood supply of the heart, which in turn affects the rhythm, rate and the pump function of the heart[12]. Many yoga practices, including asana, slow breathing (*pranayama*) and *meditation*, increase activation of the PNS and lead to mental relaxation. However, yoga techniques are more than just relaxation. One of yoga's secrets, documented in research from the Swami Vivekananda Yoga Research Foundation near Bangalore, India, is that more active practices followed by relaxing ones lead to deeper relaxation than relaxing practices alone. There is overwhelming evidence, especially from recent work on the impact of the autonomic nervous system on the heart, which supports the fact that yoga has an enormous impact on the autonomic modulation to the heart [13]. The regular practice of yoga, especially when all three components of *asana*, *pranayama* and *meditation* are included, has a positive effect on heart health.

Impact of Yoga on HRV and Autonomic Plasticity

Heart tissue is a dynamic substrate continuously changing its electrophysiological and mechanical properties in response to autonomic nervous system modulation. Various yoga techniques either alone or in combination have shown overtime and in various studies

to have a beneficial effect on balancing the autonomic functions which have been implicated in the various manifestations of cardiac diseases.

The role of the autonomic nervous system (ANS) in the pathogenesis of heart rhythm disturbances, particularly atrial fibrillation was first recognized by scientists in 1978. It has been seen in numerous studies that heart rhythm disturbances can be either sympathetically or parasympathetically (vagal) mediated. Various yoga techniques have shown to have an impact on the autonomic modulation and thus play an important role in symptomatic relief in patients with various heart rhythm disturbances like atrial fibrillation as well as in patients with various devices implanted for prevention of certain arrhythmias e.g. ICDs[8,14,15].

Anti-inflammatory Effects of Yoga

Emotional and physical stressors activate immune and endocrine pathways that can enhance proinflammatory cytokine production. There are numerous studies to demonstrate that the regular practice of yoga with all three components - *asana*, *pranayama* and *meditation* - minimize autonomic and inflammatory responses when an individual is placed in stressful situations[16].

Yoga and Stress Reduction

It is known that when under stress, there is an increase in the secretion of stress hormones, like cortisol and the adrenal hormones. Increased cortisol levels have been associated with obesity and development of diabetes, uncontrolled hypertension and acceleration of atherosclerosis. Studies have shown significant decrease in cortisol and other stress hormones (up to 40%) in patients who regularly performed

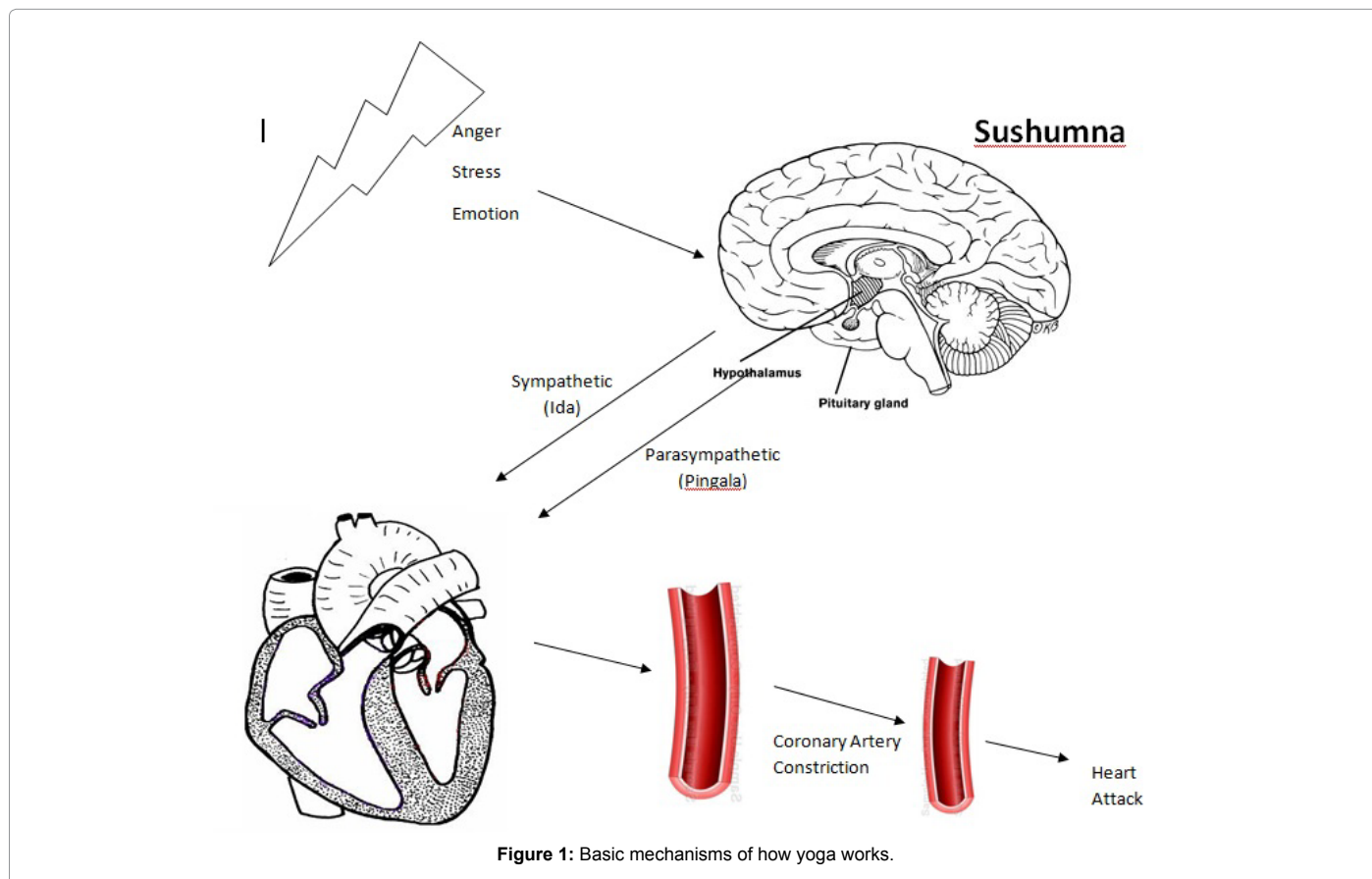


Figure 1: Basic mechanisms of how yoga works.

yoga for at least 8 weeks. The practice of yoga is well-demonstrated to reduce the physical effects of stress on the body, and found to lower cortisol levels[17]. Both hypertension and diabetes are significant risk factors for the development of heart disease (atherosclerosis and arrhythmias). Studies have shown that the above mentioned stress hormones play a major role in the control of hypertension and diabetes and it has been shown in numerous studies that regular practice of yoga significantly benefits in control of both HTN and DM[18].

Specific Benefits of Yoga in the CVD Realm

Hypertension and yoga

There are three major factors that increase the risk of developing cardiovascular disease: hypertension or high blood pressure, insulin resistance (a precursor to diabetes), and cholesterol levels[7]. With modernization and lack of physical activity, the prevalence of these risk factors for heart disease is on the rise. Hypertension is a risk factor for heart disease; significant research has been conducted to discover methods for the treatment and prevention of hypertension.

In a recent study, Iyengar yoga examined the effect of yoga when practiced by prehypertensive patients (those in the beginning stages) showed a reduction in blood pressure from pre-yoga to post-yoga period[19]. Even small decreases in blood pressure are important because they significantly lower the risk of death caused by heart disease and stroke. A separate study revealed that yoga was also effective in reducing blood pressure in patients with moderate forms of hypertension. The dose of blood pressure medications was reduced or eliminated all together in part due to yoga. The regular practice of yoga helped maintain optimal blood pressure in these patients[20]. The regular practice of yoga in patients at risk of developing high blood pressure, such as those with a sedentary lifestyle or family history of hypertension, has shown to delay the onset of cardiac symptoms[21].

Coronary artery disease and yoga

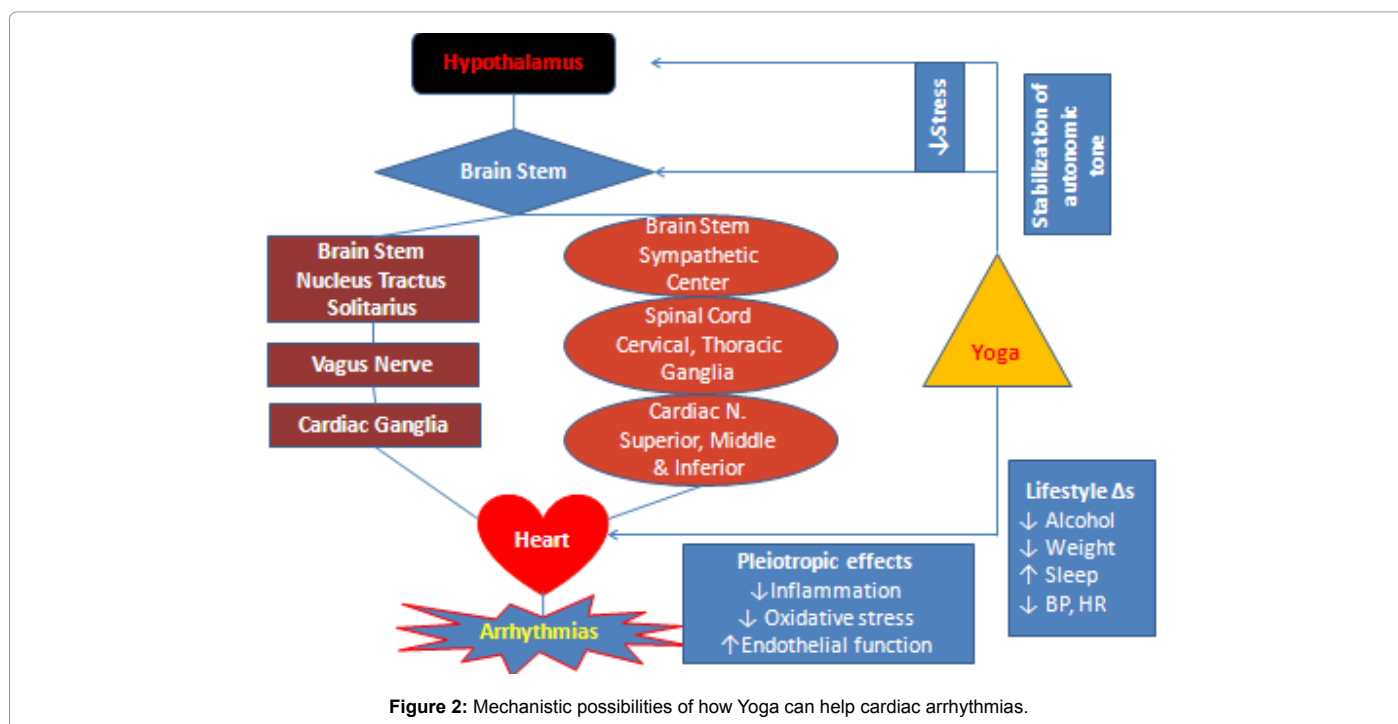
The leading cause of death in industrialized countries and the most

common form of heart disease is Coronary Artery Disease (CAD). CAD is a buildup of plaque in your arteries, reducing the flow of oxygen rich blood to the heart. This build up can lead to symptoms such as chest pain and shortness of breath, the cardinal signs of myocardial infarction (heart attack). Common causes of CAD are elevated cholesterol, stress and anxiety. The buildup of cholesterol, fat, and other substances in the blood vessels causes hardening and narrowing of the arteries leading to increased risk of stroke and death[22].

A recent study revealed that patients with a diagnosis of CAD who participated in a structured yoga program had significant reductions in blood pressure, heart rate, body fat percentage, total cholesterol, triglycerides, and LDL, compared to the non-yoga group; a reduction of these components all promote good heart health[22]. Studies have shown that yoga can reverse heart disease in those who already have damage. Yoga can help with the prevention of CAD in healthy patients while also assisting in the recovery of those with known history of cardiac damage[23,24]. Yoga also increases the flow of blood to the heart, and other vital organs allowing them to receive blood and nutrients. The practice of yoga helps relax the skeletal muscles, creating better circulation of blood and nutrients to the digestive and immune systems as well.

Arrhythmia and yoga

Numerous studies have shown the benefits of yoga on hypertension and coronary artery disease. However, only recently have the benefits of yoga in people with arrhythmia burden, or more commonly known as an irregular heartbeat, been studied. The regular practice of yoga, including *asanas* (yoga poses), *pranayama* (breathing exercises) and *meditation*, has been found to have a beneficial effect on the body's electrical system helping to restore an irregular rhythm to regular rhythm in a high percentage of patients[25]. A study conducted at the University of Kansas Medical Center has shown the role of yoga in treatment of atrial fibrillation.



Atrial fibrillation is an abnormal heart rhythm involving the atria (the top two chambers of the heart). Atrial fibrillation causes the upper half of the heart to quiver and not beat properly. While atrial fibrillation is usually not life threatening by itself, living with the arrhythmia burden can be a challenge. It can contribute to the risk of other common complications with arrhythmia, such as stroke, decrease in heart function, and reduction of exercise tolerance. It is often necessary for these patients to be on multiple medications such as blood thinners and medications to control heart rates. A recent study showed that the practice of yoga reduced the number of episodes of atrial fibrillation by 50%. It also showed a reduction in anxiety and depression scores and an overall improvement in quality of life in patients [26]. This is beneficial in public health, as many treatments of atrial fibrillation include medications with unwanted side effects or invasive procedures. Instead, the routine practice of yoga appears to be more advantageous, non-invasive, and cost effective. Another sign of a healthy heart is heart rate variability, where the time interval between heart beats varies; heart rate variability has been shown to be higher in yoga practitioners than in non-practitioners [27]. Figure 2 shows the possible mechanisms through which Yoga can influence CNS and ANS in arrhythmia control.

Yoga and heart failure

Heart failure (HF) affects approximately 5.7 million individuals in the United States every year. It is also a leading cause of hospital admissions and repeat admissions. Symptoms of HF include shortness of breath, fatigue and an overall reduction in physical functions. Many people with HF experience a diminished quality of life. Although medications have improved both symptoms and decreased mortality, side effects and substantial risks plague the consistent use of these medications [28-30]. In a study of an 8-week program of yoga comprising the three components of *asanas*, *pranayamas* and *meditation* for patients with HF, the major findings were:

1. A modified yoga program was shown to be safe in chronic HF patients that were considered stable.
2. HF patients who participate in a modified yoga program can improve their physical function (e.g., strength, balance, and endurance).
3. HF patients who participated in a modified yoga program had a significant improvement in their quality of life.

Yoga therapy offered additional benefits to the standard medical care of predominantly HF patients by improving cardiovascular endurance, quality of life and flexibility.

The “Yoga My Heart” study

The ‘YOGA My Heart’ Study [26] was a prospective study conducted at the University of Kansas Medical Center and was spearheaded by our group. The context under which the study was conducted was that yoga reduces stress, stabilizes the autonomic nervous system and benefits cardiovascular health and that yoga reduces arrhythmia burden. The study was conducted to examine the impact of yoga on the AF burden, quality of life (QoL) and depression and anxiety as there was no existing data to show this.

AF frequently affects the quality of life (QoL) and imposes a significant psychosocial burden both on the individual as well as the society in addition to the significant morbidity and mortality burden (more heart failures, hospitalizations, increased incidence of strokes and heart attacks). AF patients have much worse QoL compared to

the general population, even more than patients with coronary artery disease and congestive heart failure.

In this study, patients with paroxysmal AF between 18-80 years of age were screened. After appropriate screening, 52 patients were enrolled in the study. The enrollment duration was 27 months. Iyengar yoga was used as an interventional therapy in this study. All training sessions were conducted in groups of 20-25 people in a yoga studio by a certified professional yoga instructor. These sessions lasted for approximately 60 minutes two times a week over a period of three months. During each yoga session, 10 minutes of pranayamas, 10 minutes of warm-up exercises, 30 minutes of asanas, and 10 minutes of relaxation exercises were performed. The patients were encouraged to perform all exercises as accurately as possible.

The *pranayamas* used in the study were:

Ujjayi pranayama
Dirgha pranayama and
Nadishodhanaprayanama

The *asanas* included:

sukhasana
bitilansana
adhomukhvirasana
dandasana
janusirsana
paschimottanasana
tadasana
uttanasana
setubandhasarvangasana
sputapadangusthasana
pavanamuktasana and
savasana

Each asana lasted 30-60 seconds and some of them were repeated multiple times during a session. Patients relaxed at the end of each yoga session, with 10 minutes of savasana followed by meditation practiced for relaxation.

All patients were provided with log sheets to record the symptoms of AF during the period. Patients’ symptoms and cardiac rhythms were also monitored using cardiac event monitors and the data was statistically analyzed at the end of the study. Statistical analysis of the data showed that although practicing yoga does not cure AF, it significantly improves symptoms, arrhythmia burden, anxiety & depression scores, physical functioning, general health, vitality and social functioning in patients suffering from AF. Yoga resulted in up to 50% reduction of symptomatic AF episodes. Yoga is an effective complementary and alternative therapy in the management of patients with AF.

Conclusion

Yoga can be tailored to each individual, increasing both fitness and energy levels of those participating in it. This individualized characteristic of yoga is valuable to many, but especially to people with cardiovascular disease who may be weaker and more easily fatigued than

heart healthy individuals. Current studies at the University of Kansas Medical Center are investigating the effects of yoga in patients with arrhythmias, including neurocardiogenic syncope (sudden and brief loss of consciousness) and inappropriate sinus tachycardia (sensation of heart racing at times). Yoga may compliment more invasive procedures and current treatments/medications. It may also help in the future to help elucidate the mechanism from which these conditions manifest.

Based on current studies, yoga is beneficial both as a treatment (to an extent in conjunction with medical measures) and as a preventative measure against cardiovascular disease. Along with these benefits, yoga is cost-effective, straightforward to learn, and has minimal side effects. We are just beginning to uncover the true benefits that yoga has on cardiovascular disease. Additional research will help us understand and unlock the vast number of potential benefits that yoga can provide in maintaining a healthy heart.

References

1. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, et al. (2013) Executive summary: Heart disease and stroke statistics—2013 update: a report from the American heart association. *Circulation* 127: 143-152.
2. Yogendra J, Yogendra HJ, Ambardekar S, Lele RD, Shetty S, et al. (2004) Beneficial effects of yoga lifestyle on reversibility of ischaemic heart disease: Caring heart project of international board of yoga. *J Assoc Physicians India* 52: 283-289.
3. Bharshankar JR, Bharshankar RN, Deshpande VN, Kaore SB, Gosavi GB (2003) Effect of yoga on cardiovascular system in subjects above 40 years. *Indian J Physiol Pharmacol* 47: 202-206.
4. Damodaran A, Malathi A, Patil N, Shah N, Suryavanshi, et al. (2002) Therapeutic potential of yoga practices in modifying cardiovascular risk profile in middle aged men and women. *J Assoc Physicians India* 50: 633-640.
5. Bhavanani AB, Madanmohan, Sanjay Z, Basavaraddi IV (2012) Immediate cardiovascular effects of pranava pranayama in hypertensive patients. *Indian J Physiol Pharmacol* 56: 273-278.
6. Shantakumari N, Sequeira S, El Deeb R (2013) Effects of a yoga intervention on lipid profiles of diabetes patients with dyslipidemia. *Indian heart J* 65: 127-131.
7. Ross A, Thomas S (2010) The health benefits of yoga and exercise: A review of comparison studies. *J Altern Complement Med* 16: 3-12.
8. Muralikrishnan K, Balakrishnan B, Balasubramanian K, Visnegarawla F (2012) Measurement of the effect of isha yoga on cardiac autonomic nervous system using short-term heart rate variability. *J Ayurveda Integr Med* 3: 91-96.
9. Telles S, Raghavendra BR, Naveen KV, Manjunath NK, Kumar S, et al. (2013) Changes in autonomic variables following two meditative states described in yoga texts. *Journal of alternative and complementary medicine* 19: 35-42.
10. Danesh J, Wheeler JG, Hirschfield GM, Eda S, Eiriksdottir G, et al. (2004) C-reactive protein and other circulating markers of inflammation in the prediction of coronary heart disease. *N Engl J Med* 350: 1387-1397.
11. Sarvottam K, Magan D, Yadav RK, Mehta N, Mahapatra SC (2013) Adiponectin, interleukin-6, and cardiovascular disease risk factors are modified by a short-term yoga-based lifestyle intervention in overweight and obese men. *J Altern Complement Med* 19: 397-402.
12. Palatini P, Julius S (2009) The role of cardiac autonomic function in hypertension and cardiovascular disease. *Curr Hypertens Rep* 11: 199-205.
13. Patel NK, Newstead AH, Ferrer RL (2012) The effects of yoga on physical functioning and health related quality of life in older adults: A systematic review and meta-analysis. *J Altern Complement Med* 18: 902-917.
14. Cheema BS, Houridis A, Busch L, Raschke-Cheema V, Melville GW, et al. (2013) Effect of an office worksite-based yoga program on heart rate variability: Outcomes of a randomized controlled trial. *BMC Complement Altern Med* 13: 82.
15. Streeter CC, Gerbarg PL, Saper RB, Ciraulo DA, Brown RP (2012) Effects of yoga on the autonomic nervous system, gamma-aminobutyric-acid, and allostasis in epilepsy, depression, and post-traumatic stress disorder. *Med Hypotheses* 78: 571-579.
16. Yadav RK, Magan D, Mehta N, Sharma R, Mahapatra SC (2012) Efficacy of a short-term yoga-based lifestyle intervention in reducing stress and inflammation: Preliminary results. *J Altern Complement Med* 18: 662-667.
17. Thirthalli J, Naveen GH, Rao MG, Varambally S, Christopher R, et al. (2013) Cortisol and antidepressant effects of yoga. *Indian J Psychiatry* 55: 405-408.
18. Parswani MJ, Sharma MP, Iyengar S (2013) Mindfulness-based stress reduction program in coronary heart disease: A randomized control trial. *Int J Yoga* 6: 111-117.
19. Cohen DL, Bloedon LT, Rothman RL, Farrar JT, Galantino ML, et al. (2011) Iyengar yoga versus enhanced usual care on blood pressure in patients with prehypertension to stage I hypertension: A randomized controlled trial. *Evid Based Complement Alternat Med*.
20. Mizuno J, Monteiro HL (2013) An assessment of a sequence of yoga exercises to patients with arterial hypertension. *J Bodyw Mov Ther* 17: 35-41.
21. Miles SC, Chun-Chung C, Hsin-Fu L, Hunter SD, Dhindsa M, et al. (2013) Arterial blood pressure and cardiovascular responses to yoga practice. *Altern Ther Health Med* 19: 38-45.
22. Manchanda SC, Narang R, Reddy KS, Sachdeva U, Prabhakaran D, et al. (2000) Retardation of coronary atherosclerosis with yoga lifestyle intervention. *J Assoc Physicians India* 48: 687-694.
23. Alexander GK, Innes KE, Selfe TK, Brown CJ (2013) "More than I expected": Perceived benefits of yoga practice among older adults at risk for cardiovascular disease. *Complement Ther Med* 21: 14-28.
24. Lau HL, Kwong JS, Yeung F, Chau PH, Woo J (2012) Yoga for secondary prevention of coronary heart disease. *Cochrane Database Syst Rev* 12: CD009506.
25. Yalta K, Sivri N, Yetkin E (2011) Sahaja yoga: A unique adjunctive approach for the management of cardiac arrhythmias? *Int J Cardiol* 152: 99-100.
26. Lakkireddy D, Atkins D, Pillarisetti J, Ryschon K, Bommana S, et al. (2013) Effect of yoga on arrhythmia burden, anxiety, depression, and quality of life in paroxysmal atrial fibrillation: The yoga my heart study. *J Am Coll Cardiol* 61: 1177-1182.
27. Khattab K, Khattab AA, Ortak J, Richardt G, Bonnemeier H (2007) Iyengar yoga increases cardiac parasympathetic nervous modulation among healthy yoga practitioners. *Evid Based Complement Alternat Med* 4: 511-517.
28. Howie-Esquivel J, Lee J, Collier G, Mehling W, Fleischmann K (2010) Yoga in heart failure patients: A pilot study. *J Card Fail* 16: 742-749.
29. Pullen PR, Thompson WR, Benardot D, Brandon LJ, Mehta PK, et al. (2010) Benefits of yoga for african american heart failure patients. *Med Sci Sports Exerc* 42: 651-657.
30. Kubo A, Hung YY, Ritterman J (2011) Yoga for heart failure patients: A feasibility pilot study with a multiethnic population. *Int J Yoga Therap* 77-83.