

## YOGA AND MIND BODY THERAPIES IN HEALTH AND DISEASE: A BRIEF REVIEW

Ananda Balayogi Bhavanani \*, Meena Ramanathan \*\*, Madanmohan \*\*\*

### Introduction

“Oh, East is East, and West is West, and never the twain shall meet,” said Rudyard Kipling. This dichotomy however seems to have been overcome in recent times, as many eastern healing traditions have slowly and steadily percolated the health care system worldwide. This is especially true of mind-body therapies that focus on the health promotive intrinsic connections that exist between the human brain, mind, body, and individual behaviour. This includes techniques of meditation (mantra meditation, mindfulness meditation, and others), qi gong, tai chi, and yoga.<sup>1</sup> In the USA, reported use of deep breathing, meditation, and yoga increased between 2002 and 2007 with 12.7% of adults using deep-breathing exercises, 9.4% practicing meditation, and 6.1% taking up yoga.<sup>2,3</sup> Pain related issues were the top usage statistics while more than 40% of adults with neuropsychiatric symptoms were drawn to the usage of various mind-body therapies.<sup>4</sup>

### Yoga As A Therapy

Yoga as a mode of therapy (yoga chikitsa) has become extremely popular, and a great number of studies and systematic reviews offer scientific evidence of its potential in treating a wide range of psychosomatic conditions. Yoga understands health and well-being as a dynamic continuum of human nature and not merely a ‘state’ to be reached and maintained. Yoga helps the individual to establish “sukha sthanam”, which may be defined as a dynamic sense of physical, mental, and spiritual well-being. Yogamaharishi Dr. Swami Gitananda Giri Guru Maharaj, the visionary founder of Ananda Ashram at the ICYER, Pondicherry ([www.icyer.com](http://www.icyer.com)) and one of the foremost authorities on Yoga in the past century exclaimed lucidly, “Yoga chikitsa is virtually as old as yoga itself, indeed, the return of mind that feels separated from the Universe in which it exists

represents the first yoga therapy. Yoga chikitsa could be termed as man’s first attempt at unitive understanding of mind-emotions-physical distress and is the oldest wholistic concept and therapy in the world.”<sup>5</sup>

To achieve this yogic integration at all levels of our being, it is essential that we take into consideration the all encompassing multi dimensional aspects of yoga that include the following: a healthy life-nourishing diet, a healthy and natural environment, a wholistic lifestyle, adequate bodywork through asana, mudra-bandha and kriya, invigorating breath work through pranayama and the cultivation of a healthy thought process through jnana yoga and raja yoga.

The International Association of Yoga Therapists (IAYT), USA has taken this idea into account in defining Yoga therapy as follows<sup>6</sup>: “Yoga therapy is the process of empowering individuals to progress toward improved health and well-being through the application of the philosophy and practice of yoga.” This has been further elaborated by the IAYT in its “Recommended Educational Standards for the Training of Yoga Therapists”, published on 1 July, 2012.<sup>7</sup> This is one of the best documents on standards in yoga therapy and is a path breaking effort covering comprehensively all aspects of yoga as a holistic therapy.

The need of the hour is for a symbiotic relationship between yoga and modern science. To satisfy this need, living, human bridges combining the best of both worlds need to be cultivated. It is important that more dedicated scientists take up yoga and that more yogis study science, so that we can build a bridge between these two great evolutionary aspects of our civilization. The process as well as the goal of yoga is all about becoming “one” with an integrated state of being.<sup>8</sup>

---

\* Ananda Balayogi Bhavanani , Deputy Director, E mail: [yognat@gmail.com](mailto:yognat@gmail.com)

\*\* Meena Ramanathan, Co-ordinator and Yoga therapist, E mail: [saineema@yahoo.com](mailto:saineema@yahoo.com)

\*\*\* Madanmohan, Director, Prof & Head, Dept. of Physiology, E mail: [drmadanmohan999@rediffmail.com](mailto:drmadanmohan999@rediffmail.com)

Centre for Yoga Therapy, Education and Research (CYTER)

Mahatma Gandhi Medical College and Research Institute, Puducherry 607402, India

## Promotes Positive Health

Healthy life can be considered as a by-product of practicing yogic techniques since it has been observed that Yoga practitioners are physically and mentally healthier and have better coping skills to stressors than the normal population. Knowledge of inexpensive, effective and easily administrable yogic techniques by health professionals will go a long way in helping us achieve the goal of the World Health Organisation to provide “physical, mental, spiritual and social health” for all sections of human society.

Some of the important documented health promoting benefits of mind-body practices such as yoga and meditation include:

1. Improvement in cardio-respiratory efficiency<sup>9, 10, 11, 12</sup>
2. Improvement in exercise tolerance<sup>13, 14, 15, 16</sup>
3. Harmonious balance of autonomic function<sup>17, 18, 19, 20</sup>

4. Improvement in dexterity, strength, steadiness, stamina, flexibility, endurance, and neuro-musculo-skeletal coordination<sup>13, 21, 22, 23, 24, 25, 26</sup>
5. Increase in alpha rhythm, inter-hemispheric coherence and homogeneity in the brain<sup>27, 28, 29, 30</sup>
6. Improved sleep quality<sup>31</sup>
7. Improved cognitive functions<sup>9, 32, 33, 34, 35, 36, 37, 38</sup>
8. Alteration in brain blood flow and brain metabolism<sup>39, 40, 41, 42</sup>
9. Modulation of the neuro-endocrine axis<sup>43, 44, 45, 46, 47, 48</sup>

We can say that the eastern mind-body techniques affect every cell of the human body. They bring about better neuro-effector communication, improve strength, and enhance optimum functioning of all organ-systems while increasing resistance against stress and diseases with resultant tranquillity, balance, positive attitude and equanimity.

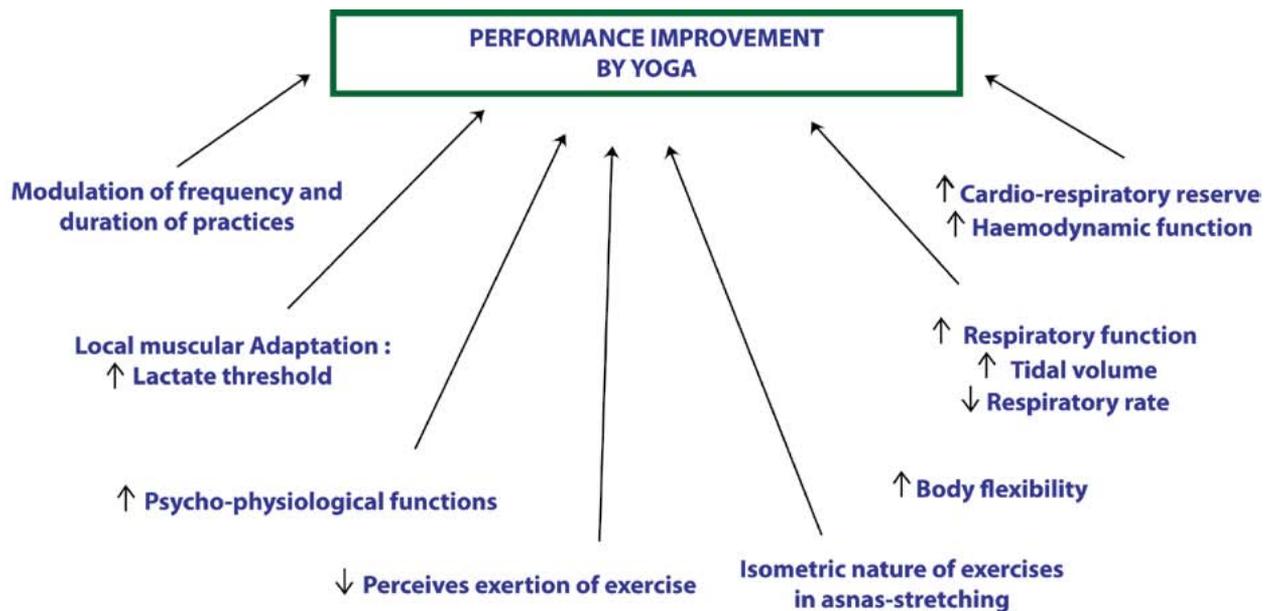


Figure1: **Possible Factors Responsible For Physical Performance Improvement By Yoga**

(Ray US, Pathak A, Tomer OS. Hatha Yoga Practices: Energy Expenditure, Respiratory Changes And Intensity Of Exercise. Evid based complement alternat med. 2011; 2011: 241294.)

## Managing Stress

It is well established that stress weakens our immune system. Scientific research in recent times has shown that the physiological, psychological and biochemical effects of yoga are of an anti-stress nature. A majority of studies have described beneficial effects

of yoga interventions in stress with an Agency for Healthcare Research and Quality (AHRQ) report stating that “Yoga helped reduce stress.”<sup>49</sup> Reductions in perceived stress following yoga are reported to be as effective as therapies such as relaxation, cognitive behavioural therapy and dance therapy.

Mechanisms postulated include the restoration of autonomic balance as well as an improvement in restorative, regenerative and rehabilitative capacities of the individual. A healthy inner sense of wellbeing produced by a life of yoga percolates down through the different levels of our existence from the higher to the lower levels producing health and wellbeing of a holistic nature. Streeter et al recently proposed a theory to explain the benefits of yoga practices in diverse, frequently co-morbid medical conditions based on the concept that yoga practices reduce allostatic load in stress response systems so that optimal homeostasis is restored.<sup>50</sup>

They hypothesized that stress produces an:

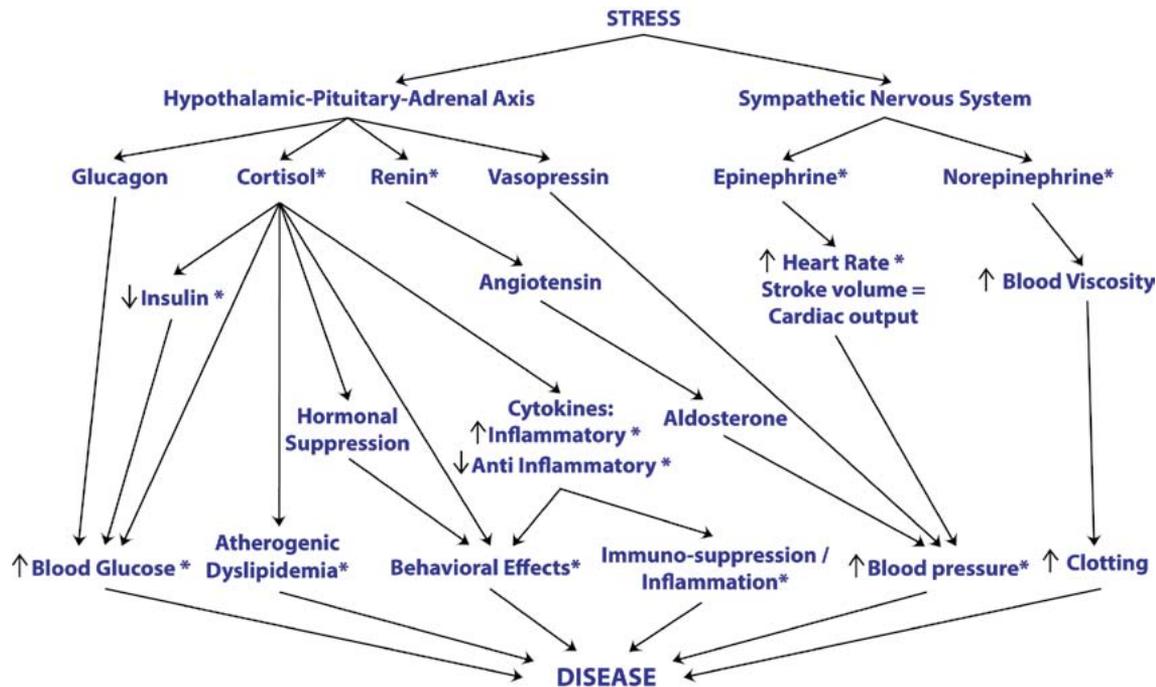
- Imbalance of the autonomic nervous system with decreased parasympathetic and increased sympathetic activity,
- Under activity of the gamma amino-butyric acid (GABA) system, the primary inhibitory neurotransmitter system, and
- Increased allostatic load.

They further hypothesized that yoga-based practices i) correct under activity of the parasympathetic nervous system and GABA systems in part through stimulation of the vagus

nerves, the main peripheral pathway of the parasympathetic nervous system, and ii) reduce allostatic load.

According to the theory proposed by them, decreased parasympathetic nervous system and GABAergic activity that underlies stress-related disorders can be corrected by yoga practices resulting in amelioration of disease symptoms. A review by Bhavanani concluded that heart rate variability (HRV) testing has a great role to play in our understanding of the intrinsic mechanisms behind such potential autonomic balancing effects of yoga.<sup>51</sup> Innes et al had earlier postulated two interconnected pathways by which yoga reduces the risk of cardiovascular diseases through the mechanisms of parasympathetic activation coupled with decreased reactivity of sympathoadrenal system and HPA axis.<sup>52</sup>

It is notable that one of the newer applications of yoga has been in managing the aftermaths of natural disasters. Studies have shown that yoga significantly reduces symptoms of posttraumatic stress disorder (PTSD), self-rated symptoms of stress (fear, anxiety, disturbed sleep, and sadness) and respiration rate.<sup>53</sup>



**Figure 2: Impact Of Stress On Hypothalamic–Pituitary–Adrenal (Hpa) Axis And Sympathetic Nervous System.**

(Sengupta P. Health Impacts of Yoga and Pranayama: A State-of-the-Art Review. Int J Prev Med 2012; 3:444–58.

\* Yoga has significant beneficial effects at these levels)

## Mental Health

Yoga can enhance one's spiritual life and perspective beyond the physical life regardless of one's particular religion.<sup>54</sup> It enables people to attain and maintain a balance between exertion and relaxation, and this produces a healthy and dynamic state of homeostatic equilibrium.<sup>5</sup> Recent studies have shown that yoga improves mood and reduces depression scores.<sup>55,56</sup> These changes have been attributed to an increased secretion of thalamic GABA with greater capacity for emotional regulation.<sup>56,57</sup> Even a 10 day yoga-based lifestyle modification program has been reported to improve subjective wellbeing scores of patients.<sup>20</sup>

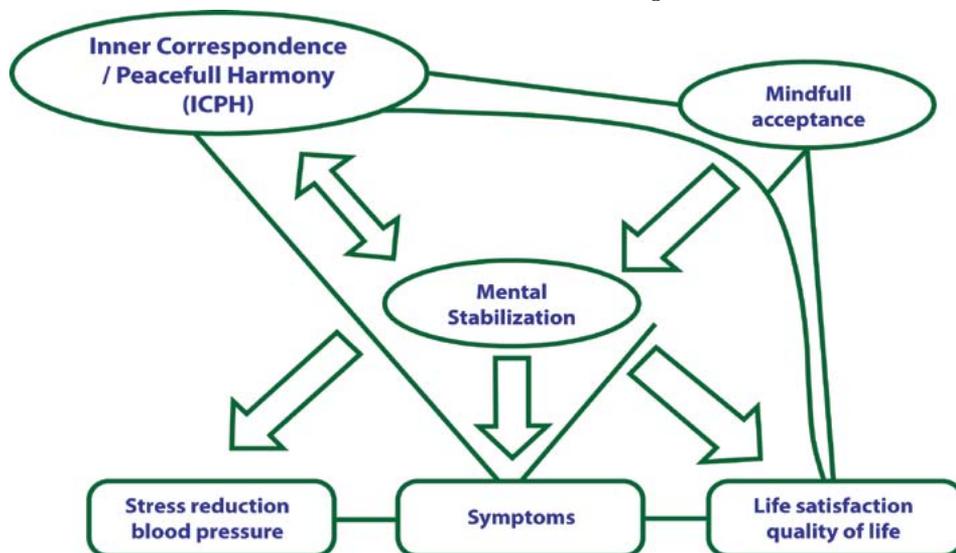
There has been extensive work done on Sudarshan Kriya Yoga and depression at the National Institute of Mental Health and Neuro Sciences (NIMHANS) in India. This technique has been recommended as a potential alternative to drugs for melancholia as a first-line treatment.<sup>58</sup>

A review by Carim-Todd et al on yoga and smoking cessation, reported positive benefits of mind-body interventions.<sup>59</sup> These interventions produced changes in smoking behaviour/in predictors of smoking behaviour such as abstinence, decreased number of cigarettes smoked, lower intensity of cravings and attitudinal changes regards smoking. However, definite conclusions

on their benefits for smoking cessation couldn't be drawn due to scarcity of papers, low quality of some publications, and numerous limitations of these studies like inadequate sample size, limitations of study design, lack of adherence monitoring, lack of objective measures, inadequate or absent control conditions and absence of blinding.

A large number of studies show that the practice of yoga can produce significant decrease in the basal anxiety scores in different populations.<sup>60, 61, 62, 63, 64, 65</sup> These reports have shown significant improvements in perceived stress, state and trait anxiety, subjective well-being, vigour and decrease in salivary cortisol, fatigue and depression. Physical well-being also increased, and those subjects suffering from headache or back pain reported marked pain relief. We can conclude that yoga and other mind body therapies do have a potential role in management of depressive and anxiety disorders.

In addition to its benefits for patients themselves, yoga also has a great role for managing depression manifesting in family caregivers of patients with dementia.<sup>66</sup> Researchers also support the promising role of yoga as an intervention for depression because it is cost-effective and easy to implement.<sup>61</sup> However a point to consider is that all the mind-body interventions do seem to be effective when compared to passive controls but reports are less conclusive when compared with active controls.<sup>67</sup>



**Figure 3: Interconnections Between Inner Correspondence / Peaceful Harmony (Icph), Mindful Acceptance & Mental /Emotional Stabilization In Response To Mind-Body Interventions Such As Yoga.**

(Arndt B'ussing et al. Inner Correspondence and peacefulness with practices among participants in Eurythmy Therapy & Yoga: A Validation Study. Evid Based Complement Alternat Med 2011; 2011: 329023.)

## Cardiovascular Conditions

Many studies have tried to explore the mechanisms by which yoga modifies coronary artery disease risk factors. Manchanda et al<sup>68</sup>, Ornish et al<sup>69</sup> and Yogendra et al<sup>70</sup> have conducted prospective, randomized and controlled trials on angiographically proven coronary artery disease patients with yoga intervention and demonstrated that yoga based lifestyle modification helps in regression of coronary lesions and improvement in myocardial perfusion. The effect of yogic lifestyle on some of the modifiable risk factors could probably explain the preventive and therapeutic beneficial effect observed in coronary artery disease.

A review of 70 eligible studies investigating the effects of yoga on risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga, reported that most had a reduction of systolic and/or diastolic pressure. However, the reviewers also noted that there were several noted potential biases and limitations that made it difficult to detect an effect specific to yoga.<sup>52</sup> Another literature review reported significant improvements in overall cardiovascular endurance of young subjects who were given varying periods of yoga training.<sup>71</sup> Physical fitness increased as compared to other forms of exercise and longer duration of yoga practice produced better cardiopulmonary endurance. In fact a detailed review of yoga in cardiac health concluded that it can be beneficial in the primary and secondary prevention of cardiovascular disease and that it can play a primary or a complementary role in this regard.<sup>72</sup>

## Respiratory Disorders

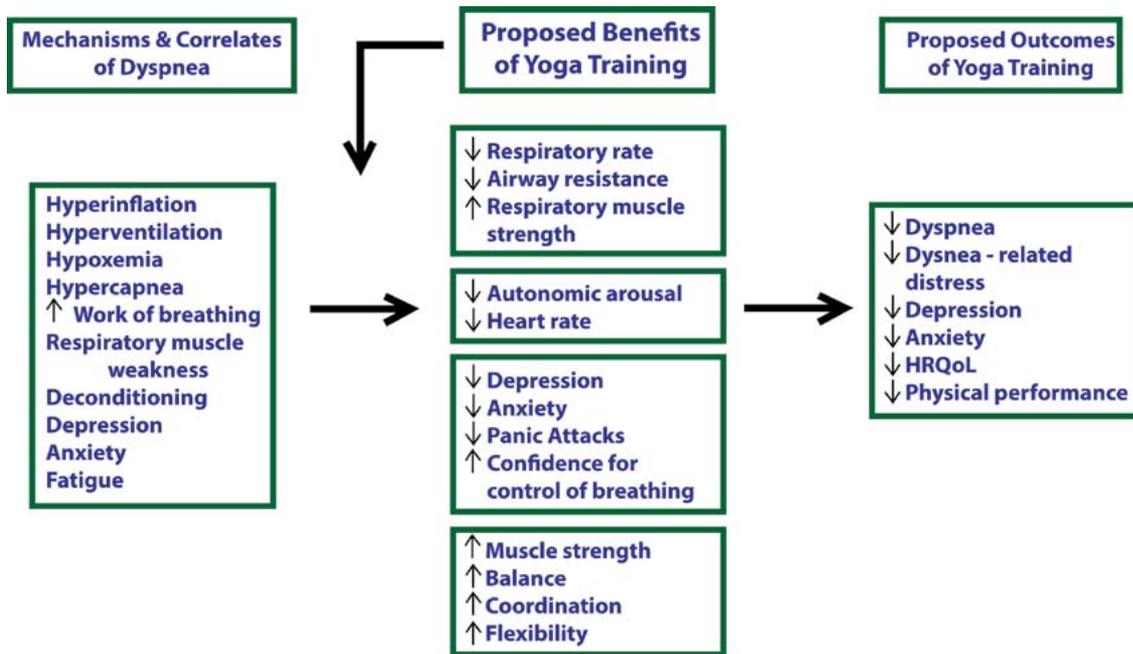
Scientific basis of using yoga as an adjunct therapy in chronic obstructive pulmonary diseases is well established with significant improvements in lung function, quality of life indices and bronchial provocation responses coupled with decreased need for regular and rescue medicinal usage.<sup>73,74</sup> Behera reported perceptible improvement in dyspnea and lung function in patients of bronchitis after 4 weeks of yoga therapy that used a variety of postures and breathing techniques.<sup>75</sup> Yogic cleaning techniques such as dhautikriya (upper gastrointestinal cleaning

with warm saline or muslin cloth) and netikriya (warm saline nasal wash) remove excessive mucous secretions, decrease inflammation and reduce bronchial hypersensitivity thereby increasing provocation threshold while kapalabhati through forceful exhalations improves the capacity to exhale against resistance.<sup>76</sup> A nonspecific broncho protective or broncho relaxing effect has been also postulated<sup>77</sup> while improved exercise tolerance has been reported following yoga therapy in patients of chronic severe airways obstruction.<sup>78</sup> It has been reported that well-performed slow yogic breathing maintains better blood oxygenation without increasing minute ventilation, reduces sympathetic activation during altitude-induced hypoxia<sup>79</sup> and decreased chemoreflex sensitivity to hypoxia and hypercapnia<sup>80</sup>. These help bring about both objective and subjective improvements in the condition of patients with bronchitis. Yoga as a therapy is also cost effective, relatively simple and carries minimal risk and hence should be advocated as an adjunct, complementary therapy in our search for an integrated system of medicine capable of producing health and wellbeing for all.

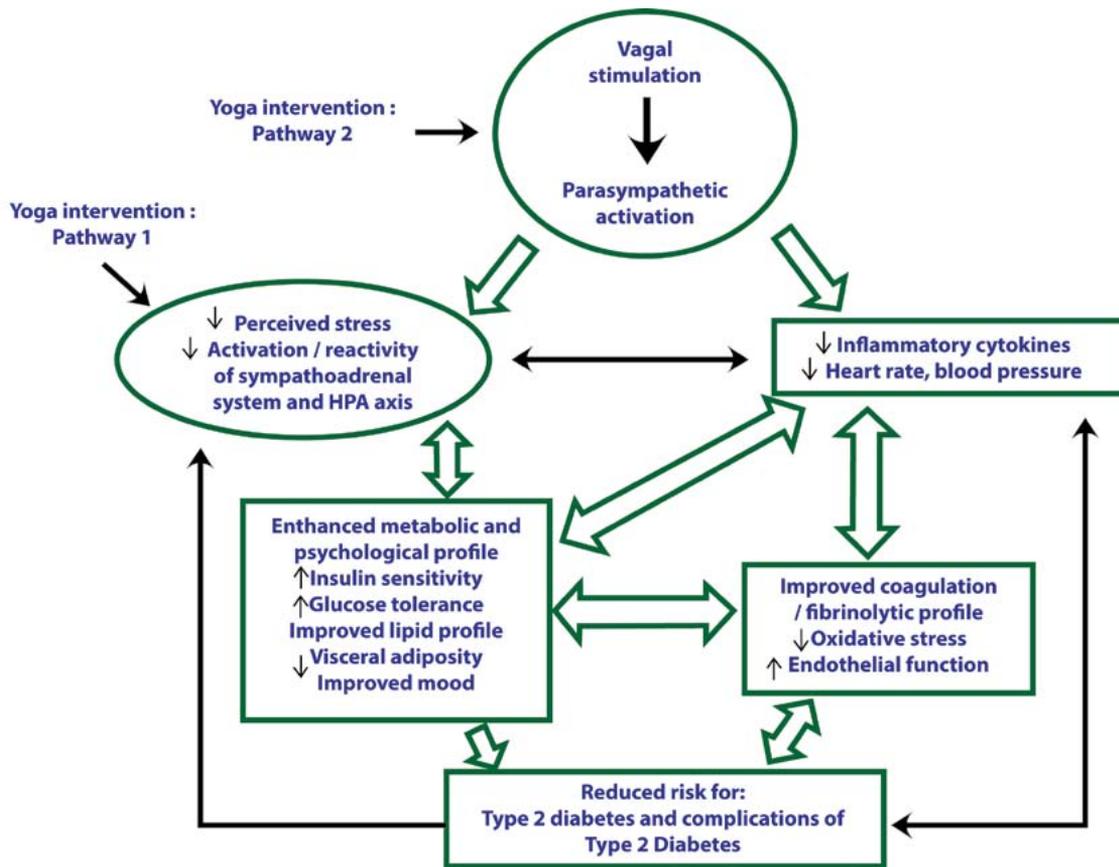
## Metabolic/Endocrine Conditions

A few RCTs have suggested that yoga and meditation practices act on the hypothalamic–pituitary–adrenal axis (HPA) axis to reduce cortisol levels in plasma,<sup>81, 82, 83, 84</sup> as well as reduce sympathetic nervous system tone, increase vagal activity,<sup>85,86</sup> and elevate brain GABA levels<sup>62</sup>.

Major systematic reviews of the effects of yoga on risk indices associated with insulin resistance syndrome and risk profiles in adults with type 2 diabetes have been done in recent times.<sup>52,87</sup> They reported post-intervention improvement in various indices but with results varying by population and study design. Another systematic review addressed the management of type 2 diabetes and concluded that the reviewed trials suggest favourable effects of yoga on short-term parameters related to diabetes but not necessarily for long-term outcome.<sup>88</sup> The AHRQ cites two studies comparing yoga versus medication which reported a large and significant reduction of fasting glucose in individuals with type 2 diabetes in one, and a smaller but still significant improvement in the other.<sup>49</sup>



**Figure 4: Proposed Relationships Among Dyspnea, Benefits of Yoga, and Outcomes of Participation In A Yoga Program.** (Donesky-Cuenca D, Nguyen Hq, Paul S, Carrieri-Kohlman V. Yoga Therapy Decreases Dyspnea-Related Distress and Improves Functional Performance In People With Chronic Obstructive Pulmonary Disease: A Pilot Study. J Altern Complement Med 2009; 15: 225–234).



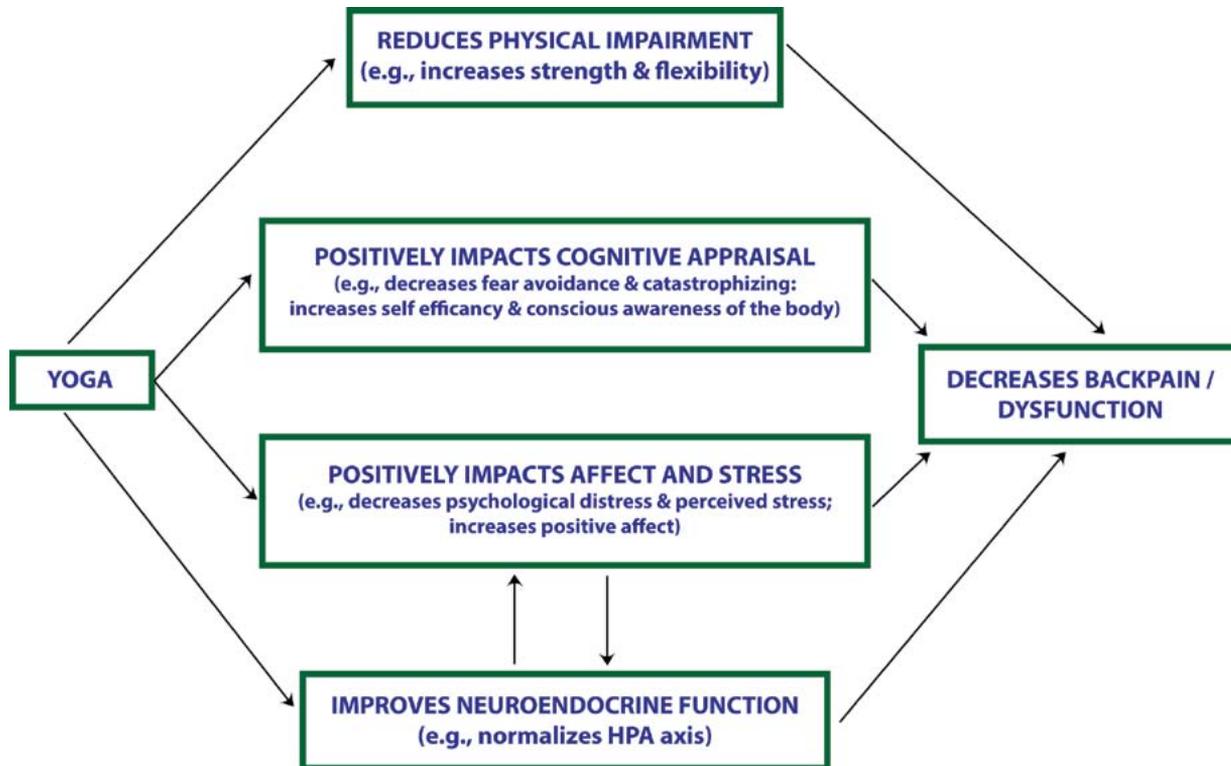
**Figure 5 Postulated Mechanisms By Which Yoga Can Help Reduce Risk For Type 2 Diabetes Mellitus And Its Complications** (Innes Ke, Vincent Hk. The Influence Of Yoga-Based Programs On Risk Profiles In Adults With Type 2 Diabetes Mellitus: A Systematic Review. Ecam 2007; 4: 469-86.)

A recent systematic review of yoga on menopausal symptoms reported small effects on psychological symptoms with no effects on total menopausal symptoms, somatic symptoms, vasomotor symptoms, or urogenital symptoms.<sup>89</sup>

### Musculoskeletal Conditions

A review by Posadzki et al<sup>90</sup> found that 10 of 11 RCTs reported significantly greater effects in favor of Yoga when compared to standard care, self-care,

therapeutic exercises, relaxing yoga, touch and manipulation, or no intervention. Yoga was more effective for chronic back pain than the control interventions such as usual care or conventional therapeutic exercises though some studies showed no between group differences.<sup>91</sup> Recently two well designed trials of yoga for back pain reported clinically meaningful benefits over usual medical care but not over an intensive stretching intervention.<sup>92,93</sup>



**Figure 6: Mechanisms Underlying Effectiveness Of Yoga For Chronic Low Back Pain.** (Sherman et al., Comparison of yoga versus stretching for chronic low back pain: protocol for the Yoga Exercise Self-care trial. *Trials* 2010; 11:36)

### Cancer

According to the findings of a comprehensive meta-analysis of role of yoga in cancer, improvements in psychological health were seen in yoga groups when compared to waitlist or supportive therapy groups.<sup>94</sup> With respect to overall quality of life, there was a trend towards improvement. To explain the positive outcomes, Smith and Pukall suggested various complex pathways which may involve relaxation, coping strategies, acceptance, and self-efficacy.<sup>95</sup> Kochupillai et al reported increase in natural killer cells in cancer patients who had completed their standard therapy after practicing Sudarshan Kriya Yoga and pranayam breathing techniques.<sup>96</sup>

A systematic review and meta-analysis of RCTs on the physical and psychosocial benefits of yoga in cancer patients and survivors by Buffart and colleagues concluded that yoga may be a feasible intervention as beneficial effects on several physical and psychosocial symptoms were reported.<sup>97</sup> They showed that it has strong beneficial effects on distress, anxiety and depression, moderate effects on fatigue, general HRQoL, emotional function and social function, small effects on functional well-being, and no significant effects on physical function and sleep disturbances. It was suggested that yoga can be an appropriate form of exercise for cancer patients and survivors who are unable or unwilling to participate in other traditional aerobic or resistance exercise programs.

## Pregnancy

Preliminary evidence from various scientific studies supports yoga's potential efficacy, particularly if started early in the pregnancy. Women practicing yoga in their second trimester reported significant reductions in physical pain from baseline to post intervention compared with women in the third trimester whose pain increased.<sup>98</sup> Women in their third trimester showed greater reductions in perceived stress and trait anxiety. Another study reported significantly fewer pregnancy discomforts at 38-40 weeks of gestation.<sup>99</sup> Subjects who participated in the yoga programme exhibited higher outcome and self-efficacy expectancies during active and second stage of labour. Provision of booklets and videos on yoga during pregnancy may contribute to a reduction in pregnancy discomforts and improved childbirth self-efficacy.

Satyapriya et al concluded that yoga reduces perceived stress and improves adaptive autonomic response to stress in healthy pregnant women<sup>100</sup> while Chuntharapat et al<sup>101</sup> concluded that yoga

produced higher levels of maternal comfort during labour and 2 hour post-labour with a decrease in subject evaluated labour pain. They also reported shorter duration of the first stage of labour, as well as total time of labour in subjects practicing yoga.

A study by Narendran et al reported a lower trend in the occurrence of complications of pregnancy such as pregnancy-induced hypertension, intrauterine growth retardation and pre-term delivery in subjects who practiced yoga.<sup>102</sup> They concluded that an integrated approach to yoga during pregnancy is safe and that it improved birth weight, decreased preterm labour, and reduced IUGR either in isolation or associated with PIH, with no increased complications.

A review by Field reported that alternative therapies have been found effective for reducing pregnancy-related back and leg pain and nausea and for reducing depression and cortisol levels and the associated prematurity rate.<sup>103</sup> It also noted that alternative therapies reduce pain and thereby the need for medication.

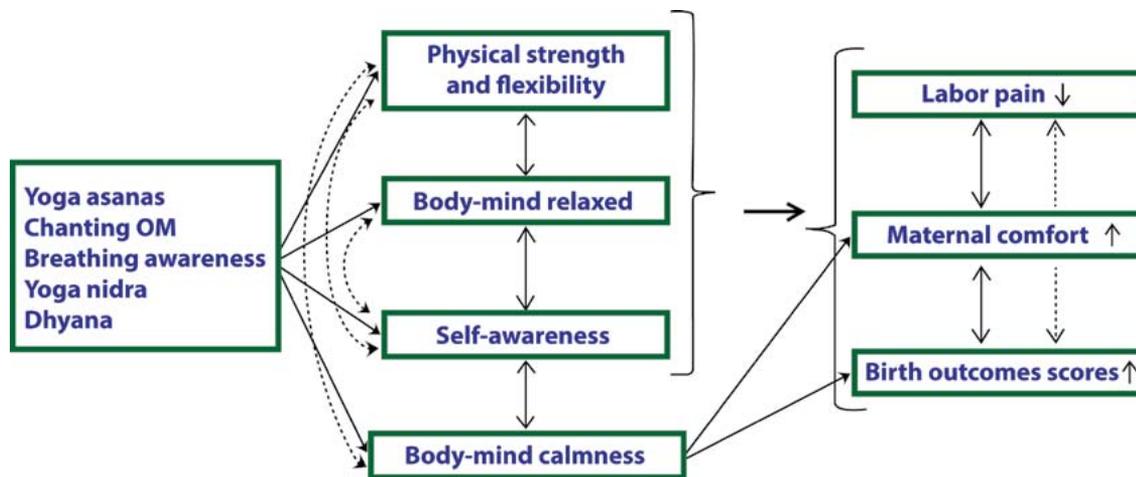


Figure 7: Postulated Mechanisms of Benefits of Yoga In Pregnancy. Chuntharapat S, Petpichetchian W, Hatthakit U. Yoga during pregnancy: effects on maternal comfort, labor pain and birth outcomes. Complement Ther Clin Pract 2008; 14(2): 105-15.

## Paediatric Population

Clinical applications of Yoga have been studied in paediatric and young adult populations with focus on physical fitness, cardio-respiratory effects, mental health, behaviour and development, irritable bowel syndrome, eating disorders, and prenatal effects on birth outcomes. Though a large majority of studies

are positive, due to methodological limitations, evidence provided is still in its infancy.<sup>104</sup> Yoga has been suggested as an option for children to increase physical activity and fitness and that yoga may be a gateway for adopting a healthy active lifestyle in sedentary children who are intimidated by more vigorous forms of exercise. They recommended

that further research is necessary to identify clinical applications of yoga for children and that such research needs to be conducted with rigorous methodology in RCTs with detailed description of protocols and reporting of results. Methodological issues specific to mind-body interventions should be addressed including adequate description of the intervention and control group, and single blinding of the outcome assessor.

A review by Galantino et al concluded that “the evidence shows physiological benefits of yoga for the paediatric population that may benefit children through the rehabilitation process, but larger clinical trials, including specific measures of QOL are necessary to provide definitive evidence.”<sup>105</sup> They rightly suggested that the type and intensity of yoga, the specific postures for the intended outcome, and the measurement of adherence beyond the clinic have to be determined. Their review showed that yoga may benefit children with mental challenges by improving their mental ability, along with motor coordination and social skills and that restoration of some degree of functional ability is possible in those having physical disabilities. It was suggested that physical therapists might apply these findings in the neuromuscular areas of learning, motor control, and coordination. A notable point mentioned by them was that, “Regardless of the goal, yoga appears to be a multitasking modality that simultaneously treats both physical impairments as well as more global issues such as stress, anxiety, or hyperactivity.”

## In Conclusion

All of the above studies and reviews suggest a number of areas where mind-body therapies such as yoga may be beneficial, but more research is required for virtually every one of them to establish their benefits conclusively. This is true in the process of introducing any new therapy into the modern health care system and is not surprising when we realize that the proper studies on yoga as a therapeutic modality are not older than a few decades.

Some of the major issues highlighted by these studies and reviews include:

1. Individual studies on yoga for various

- conditions are small
2. Poor-quality trials in general with multiple instances for bias
3. Substantial heterogeneity with regards to the
  - populations studied,
  - yoga interventions,
  - duration and frequency of yoga practice,
  - comparison groups, and
  - outcome measures.
4. Compliance was not routinely noted, thus preventing an understanding of the apt ‘dosage’ requirements with regard to the mind-body interventions
5. Yoga requires active participation and motivation that requires active efforts from both the researcher as well as the participants.
6. Changes in attitudes and behavior need to be documented and understood better, especially in the lifestyle, stress induced psychosomatic conditions.
7. It is not clear which patients may benefit from the mind-body interventions, and which aspects of the interventions or which specific styles were more effective than others.

It has been suggested that yoga may help improve patient self-efficacy, self-competence, physical fitness, and group support, and may well be effective as a supportive adjunct to mitigate medical conditions. Büssing et al concluded that yoga may have potential to be implemented as a safe and beneficial supportive/adjunct treatment that is relatively cost-effective, may be practiced at least in part as a self-care behavioral treatment, provides a life-long behavioral skill, enhances self-efficacy and self-confidence, and is often associated with additional positive side effects.<sup>106</sup>

It is important to develop objective measures of various mind-body therapies and their techniques while including them in intervention trials. It has also been suggested that the publication of specific interventions used in future studies in manual form can allow reliable replication and future implementation. It is also important to develop tools to monitor objectively the participants’ self-practice, compliance, and adherence to the interventions. Yoga has preventive, promotive as well as curative potential and a yogic lifestyle confers many advantages to

LEVEL OF ACTION AND OBSERVED EFFECTS OF YOGA INTERVENTIONS.		
<i>(Büssing A, Michalsen A, Khalsa SB, Telles S, Sherman KJ. Effects of yoga on mental and physical health: a short summary of reviews. Evid Based Complement Alternat Med 2012; 2012: 165410)</i>		
	Specific effects	Unspecific effects
COGNITION	Contemplative states; mindfulness; self-identity; self-efficacy; beliefs; expectations	Control of attentional networks
EMOTIONS	Emotional control/ regulation	Quality of Life
PHYSIOLOGY	Vagal afferent activity; heart rate / respiratory; relaxation response /stress reduction	Social contacts
PHYSICAL BODY	Physical flexibility, fitness/endurance	Healthy life style
<i>Specific and unspecific effects are often interconnected.</i>		

the practitioner. Since lifestyle related diseases are alarmingly on the rise in our modern society, yogic lifestyle should be given a special place in preventing and managing these diseases.

As suggested by Büssing et al, “Yoga may well be effective as a supportive adjunct to mitigate some medical conditions, but not yet a proven stand-alone, curative treatment. Larger-scale and more rigorous research with higher methodological quality and adequate control interventions is highly encouraged because yoga may have potential to be implemented as a beneficial supportive/adjunct treatment that is relatively cost-effective, may be practiced at least in part as a self-care behavioural treatment, provides a life-long behavioural skill, enhances self-efficacy and self-confidence and is often associated with additional positive side effects.”<sup>106</sup>

**References:**

1. Ospina MB, Bond K, Karkhaneh M, et al. Clinical trials of meditation practices in health care: characteristics and quality. *J Altern Complement Med* 2008; 14: 1199–213.
2. Barnes PM, Bloom B, Nahin RL. Complementary and alternative medicine use among adults and children: United States, 2007. *Natl Health Stat* 2008; 12: 1–23.
3. Nahin RL, Barnes PM, Stussman BJ, Bloom B. Costs

- of complementary and alternative medicine (CAM) and frequency of visits to CAM practitioners: United States, 2007. *Natl Health Stat Report* 2009; 18:1-14.
4. Purohit MP, Wells RE, Zafonte RD, Davis RB, Phillips RS. Neuropsychiatric symptoms and the use of complementary and alternative medicine. *PM&R* 2013; 5: 24–31.
5. Bhavanani AB. *Yoga Chikitsa: The application of Yoga as a therapy.* Pondicherry, India: Dhivyandanda Creations, 2013
6. Taylor MJ. What is Yoga Therapy? An IAYT definition. *Yoga Therapy in Practice* 2007; 3: 3.
7. Recommended Educational Standards for the Training of Yoga Therapists. 2012. [www.iayt.org/Documents/IAYT\\_Educational%20Standards\\_final\\_7-1-2012.pdf](http://www.iayt.org/Documents/IAYT_Educational%20Standards_final_7-1-2012.pdf)
8. Bhavanani AB. Bridging Yoga therapy and personal practice: the power of sadhana. *Int J Yoga Therap* 2012 ; 22: 89-90.
9. Madanmohan, Thombre DP, Balakumar B, et al. Effect of yoga training on reaction time, respiratory endurance and muscle strength. *Indian J Physiol Pharmacol* 1992; 36: 229-33.
10. Madanmohan, Mahadevan SK, Balakrishnan S, et al. Effect of six weeks yoga training on weight loss following step test, respiratory pressures, handgrip strength and handgrip endurance in young healthy subjects. *Indian J Physiol Pharmacol* 2008; 52: 164-70.
11. Joshi LN, Joshi VD, Gokhale LV. Effect of short term ‘Pranayam’ practice on breathing rate and ventilator functions of lung. *Indian J Physiol Pharmacol* 1992; 36: 105-08.
12. Makwana K, Khirwadkar N, Gupta HC. Effect of short term yoga practice on ventilatory function tests. *Indian J Physiol Pharmacol* 1988; 32: 202-08.
13. Bera TK and Rajapurkar MV. Body composition,

- cardiovascular endurance and anaerobic power of yogic practitioner. *Indian J Physiol Pharmacol* 1993; 37: 225-28.
14. Muralidhara DV and Ranganathan KV. Effect of yoga practice on cardiac recovery index. *Indian J Physiol Pharmacol* 1982; 26: 279-83.
  15. Madanmohan, Udupa K, Bhavanani AB, et al. Modulation of cardiovascular response to exercise by yoga training. *Indian J Physiol Pharmacol* 2004; 48: 461-65.
  16. Goleman D J and Schwartz G. E. Meditation as an intervention in stress reactivity. *J Consult Clin Psychol* 1976; 44: 456-66.
  17. Vempati RP, Telles S. Yoga based guided relaxation reduces sympathetic activity judged from baseline levels. *Psychol Rep* 2002; 90: 487-94.
  18. Vijayalakshmi P, Madanmohan, Bhavanani AB, Patil A and Kumar Babu P. Modulation of stress induced by isometric handgrip test in hypertensive patients following yogic relaxation training. *Indian J Physiol Pharmacol* 2004; 48: 59-64.
  19. Shannahoff-Khalsa DS, Kennedy B. The effects of unilateral forced nostril breathing on heart. *Int J Neurosci* 1993; 73: 47-60.
  20. Sharma R, Gupta N, Bijlani RL. Effect of Yoga based lifestyle intervention on subjective well-being. *Indian J Physiol Pharmacol* 2008; 52: 123-31
  21. Hart CE, Tracy BL. Yoga as steadiness training: Effects on motor variability in young adults. *J Strength Cond Res* 2008; 22: 1659-69.
  22. Dhume RR, Dhume RA. A comparative study of the driving effects of dextroamphetamine and yogic meditation on muscle control for the performance of balance board. *Indian Journal Physiol Pharmacol* 1991; 35: 191-94.
  23. Raghuraj P, Telles S. Immediate effect of specific nostril manipulating yoga breathing practices on autonomic and respiratory variables. *Appl Psychophysiol Biofeedback* 2008; 33: 65-75.
  24. Raju PS, Madhavi S, Prasad KV, et al. Comparison of effects of yoga and physical exercise in athletes. *Indian J Med Res* 1994; 100: 81-86.
  25. Ray US, Mukhopadhyaya S, Purkayastha SS, et al. Effect of exercises on physical and mental health of young fellowship trainees. *Indian J Physiol Pharmacol* 2001; 45: 37-53.
  26. DiBenedetto M, Innes KE, Taylor AG, et al. Effect of a gentle Iyenger yoga program on gait in the elderly: an exploratory study. *Arch Phys Med Rehabil* 2005; 86: 1830-37.
  27. Khare KC, Nigam SK. A study of electroencephalogram in meditators. *Indian J Physiol Pharmacol* 2000; 44: 173-78.
  28. Sharma VK, Das S, Mondal S, Goswami U, Gandhi A. Comparative effect of sahad yoga on EEG in patients of major depression and healthy subjects. *Biomedicine* 2007; 27: 95-99.
  29. Sarang SP and Telles S. Changes in p300 following two yoga-based relaxation techniques. *Int J Neurosci* 2006; 116: 1419-30.
  30. Stancák A Jr, Kuna M. EEG changes during forced alternate nostril breathing. *Int J Psychophysiol* 1994; 18: 75-79.
  31. Patra S and Telles S. Positive impact of cyclic meditation on subsequent sleep. *Med Sci Monit* 2009; 15: CR375-81.
  32. Malathi A and Parulkar VG. Effect of yogasanas on the visual and auditory reaction time. *Indian J Physiol Pharmacol* 1989; 3: 110-12.
  33. Bhavanani AB, Madanmohan, Udupa K. Acute effect of Mukh bhastrika (a yogic bellows type breathing) on reaction time. *Indian J Physiol Pharmacol* 2003;47: 297-300.
  34. Sarang SP and Telles S. Immediate effect of two yoga-based relaxation techniques on performance in a letter-cancellation task. *Percept Mot Skills* 2007; 105: 379-85.
  35. Joshi M and Telles S. Immediate effects of right and left nostril breathing on verbal and spatial scores. *Indian J Physiol Pharmacol* 2008; 52: 197-200.
  36. Telles S, Raghuraj P, Ghosh A, Nagendra HR. Effect of a one-month yoga training program on performance in a mirror-tracing task. *Indian J Physiol Pharmacol*. 2006; 50:187-90.
  37. Telles S, Nagarathna R, Vani PR, Nagendra HR. A combination of focusing and defocusing through yoga reduces optical illusion more than focusing alone. *Indian J Physiol Pharmacol* 1997; 41: 179-82.
  38. Vani PR, Nagarathna R, Nagendra HR, Telles S. Progressive increase in critical flicker fusion frequency following yoga training. *Indian J Physiol Pharmacol* 1997; 41: 71-74.
  39. Herzog H, Lele VR, Kuwert T, et al. Changed pattern of regional glucose metabolism during yoga meditative relaxation. *Neuropsychobiology* 1990; 23:182-87.
  40. Lou HC, Kjaer TW, Friberg L, et al. A 15O-H2O PET study of meditation and the resting state of normal consciousness. *Hum Brain Mapp* 1999; 7: 98-105.
  41. Hölzel BK, Ott U, Gard T, et al. Investigation of mindfulness meditation practitioners with voxel-based morphometry. *Soc Cogn Affect Neurosci* 2008; 3: 55-61.
  42. Luders E, Toga AW, Lepore N, Gaser C. The underlying anatomical correlates of long-term meditation: larger hippocampal and frontal volumes of gray matter. *Neuroimage* 2009; 45: 672-78.
  43. Chaya MS, Ramakrishnan G, Shastry S, et al. Insulin sensitivity and cardiac autonomic function in young male practitioners of yoga. *Natl Med J India* 2008; 21: 215-16.
  44. Manjunatha S, Vempati RP, Ghosh D, Bijlani RL. An investigation into the acute and long-term effects of selected yogic postures on fasting and postprandial glycemia and insulinemia in healthy young subjects. *Indian J Physiol Pharmacol* 2005; 49: 319-24.
  45. Schmidt T, Wijga A, Von Zur Mühlen A, Brabant G, Wagner TO. Changes in cardiovascular risk factors and hormones during a comprehensive residential three month kriya yoga training and vegetarian nutrition. *Acta Physiol Scand Suppl* 1997; 640: 158-62.
  46. Kamei T, Toriumi Y, Kimura H, Ohno S, Kumano H, Kimura K. Decrease in serum cortisol during yoga exercise is correlated with alpha wave activation. *Percept Mot Skills* 2000; 90: 1027-32.
  47. Tooley GA, Armstrong SM, Norman TR, Sali A. Acute increases in night-time plasma melatonin levels following a period of meditation. *Biol Psychol* 2000; 53: 69-78.
  48. Harinath K, Malhotra AS, Pal K, et al. Effects of Hatha yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. *J Altern Complement Med* 2004; 10: 261-68.

49. Ospina MB, Bond K, Karkhaneh M, et al. Meditation practices for health: state of the research. *Evid Rep Technol Assess* 2007; 155: 1-263.
50. Streeter CC, Gerbarg PL, Saper RB, Ciraulo DA, Brown RP. Effects of Yoga on the autonomic nervous system, gamma-aminobutyric-acid, and allostasis in epilepsy, depression, and post-traumatic stress disorder. *Med Hypotheses* 2012; 78:571-9.
51. Bhavanani AB. HRV as a research tool in Yoga. *Yoga Mimamsa* 2012; 44: 188-99
52. Innes KE, Bourguignon C, Taylor AG. Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with Yoga: a systematic review. *J Am Board Fam Pract* 2005; 18: 491-519.
53. Telles S, Singh N, Balkrishna A. Managing mental health disorders resulting from trauma through Yoga: a review. *Depression Research and Treatment* 2012; 2012: 401513.
54. Nespor K. Twelve years of experience with Yoga in psychiatry. *Int J Psychosom* 1993; 40:105-07.
55. Lavey R, Sherman T, Mueser KT, et al. The effects of Yoga on mood in psychiatric inpatients. *Psychiatr Rehabil J* 2005; 28: 399-402
56. Shapiro D, Cook IA, Davydov DM, et al. Yoga as a complementary treatment of depression: Effects of traits and moods on treatment outcome. *Evid Based Complement Alternat Med* 2007;4: 493-502.
57. Streeter CC, Whitfield TH, Owen L, et al. Effects of Yoga versus walking on mood, anxiety, and brain GABA levels: A randomized controlled MRS study. *J Altern Complement Med* 2010;16:1145-52.
58. Janakiramaiah N, Gangadhar BN, Naga Venkatesha Murthy PJ, et al. Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: A randomized comparison with electroconvulsive therapy (ECT) and imipramine. *J Affect Disord* 2000; 57: 255-59.
59. Carim-Todd L, Mitchell SH, Oken BS. Mind-body practices: An alternative, drug-free treatment for smoking cessation? A systematic review of the literature. *Drug and Alcohol Dependence* 2013; 132 :399- 410.
60. Khalsa SB, Shorter SM, Cope S, Wyshak G, Sklar E. Yoga ameliorates performance anxiety and mood disturbance in young professional musicians. *Appl Psychophysiol Biofeedback* 2009; 34: 279-89.
61. Javnbakht M, Hejazi Kenari R, Ghasemi M. Effects of yoga on depression and anxiety of women. *Complement Ther Clin Pract* 2009; 15: 102-04.
62. Kozasa EH, Santos RF, Rueda AD, et al. Evaluation of Siddha Samadhi yoga for anxiety and depression symptoms: a preliminary study. *Psychol Rep* 2008; 103: 271-74.
63. Woolery A, Myers H, Sternlieb B, Zeltzer L. A yoga intervention for young adults with elevated symptoms of depression. *Altern Ther Health Med* 2004; 10: 60-63.
64. Sharma VK, Das S, Mondal S, Goswami U, Gandhi A. Effect of sahad yoga on depressive disorders. *Indian J Physiol Pharmacol* 2005; 49: 462-68.
65. Michalsen A, Grossman P, Acil A, et al. Rapid stress reduction and anxiolysis among distressed women as a consequence of a three-month intensive yoga program. *Med Sci Monit* 2005; 11: CR555-561.
66. Waelde LC, Thompson L, Gallagher-Thompson D. A pilot study of a Yoga and meditation intervention for dementia caregiver stress. *J ClinPsychol* 2004; 60: 677-87.
67. Uebelacker LA, Epstein-Lubow G, Gaudiano BA, et al. Hatha yoga for depression: critical review of the evidence for efficacy, plausible mechanisms of action, and directions for future research. *J Psychiatr Pract* 2010; 16: 22-33.
68. Manchanda SC, Narang R, Reddy KS, et al. Retardation of coronary atherosclerosis with yoga lifestyle intervention. *J Assoc Physicians India* 2000; 48: 687-94.
69. Ornish D, Brown SE, Scherwitz LW, et al. Can lifestyle changes reverse coronary heart disease? *The Lifestyle Heart Trial. Lancet.* 1990; 336: 129-33.
70. Yogendra J, Yogendra HJ, Ambardekar S, et al. Beneficial effects of yoga lifestyle on reversibility of ischaemic heart disease: caring heart project of International Board of Yoga. *J Assoc Physicians India* 2004; 52: 283-89.
71. Raub JA. Psychophysiologic effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: a literature review. *Journal of Alternative and Complementary Medicine* 2002; 8: 797-812.
72. Jayasinghe SR. Yoga in cardiac health (a review). *European Journal of Cardiovascular Prevention and Rehabilitation* 2004; 11: 369-75.
73. Nagarathna R, Nagendra HR. Yoga for bronchial asthma: a controlled study. *BMJ* 1985; 291: 1077-79.
74. Vempati R, Bijlani RL, Deepak KK. The efficacy of a comprehensive lifestyle modification programme based on Yoga in the management of bronchial asthma: a randomized controlled trial. *BMC Pulm Med* 2009 ; 30; 9: 37.
75. Behera D. Yoga therapy in chronic bronchitis. *J Assoc Physicians India* 1998; 46: 207-08.
76. Satyaprabha TN, Murthy H, Murthy BTC. Efficacy of naturopathy and Yoga in bronchial asthma - a self-controlled matched scientific study. *IJPP* 2001; 45: 80-86.
77. Singh V. Effect of respiratory exercises on asthma. *The Pink City lung exerciser. Journal of Asthma* 1987; 24: 355-59.
78. Tandon M K. Adjunct treatment with Yoga in chronic severe airways obstruction. *Thorax* 1978; 33: 514-17
79. Bernardi L, Passino C, Wilmerding Vetal. Breathing patterns and cardiovascular autonomic modulation during hypoxia induced by simulated altitude. *J Hypertens* 2001; 19 : 947-58
80. Spicuzza L, Gabutti A, Porta C, Montano N, Bernardi L. Yoga and chemoreflex response to hypoxia and hypercapnia. *Lancet* 2000 ; 356: 1495-96
81. Brand S, Holsboer-Trachsler E, Naranjo JR, Schmidt S. Influence of mindfulness practice on cortisol and sleep in long-term and short-term meditators. *Neuropsychobiology* 2012; 65: 109-18.
82. Vadiraja HS, Raghavendra RM, Nagarathna R, et al. Effects of a yoga program on cortisol rhythm and mood states in early breast cancer patients undergoing adjuvant radiotherapy: a randomized controlled trial. *Integr Cancer Ther* 2009; 8: 37-46.
83. Vedamurthachar A, Janakiramaiah N, Hegde JM, et al. Antidepressant efficacy and hormonal effects of Sudarshana Kriya Yoga (SKY) in alcohol dependent individuals. *J Affect Disord* 2006; 94: 249-53.

84. West J, Otte C, Geher K, Johnson J, Mohr DC. Effects of hatha yoga and African dance on perceived stress, affect, and salivary cortisol. *Ann Behav Med* 2004; 28: 114–18.
85. Bernardi L, Wdowczyk-Szulc J, Valenti C, et al. Effects of controlled breathing, mental activity and mental stress with or without verbalization on heart rate variability. *J Am Coll Cardiol* 2000; 35: 1462–69.
86. Riley D. Hatha yoga and the treatment of illness. *Altern Ther Health Med* 2004; 10: 20–21.
87. Innes KE, Vincent HK. The influence of Yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: a systematic review. *Evidence-Based Complementary and Alternative Medicine* 2007; 4: 469–86.
88. Aljasir B, Bryson M, Al-Shehri B. Yoga Practice for the Management of Type II Diabetes Mellitus in Adults: A systematic review. *Evid Based Complement Alternat Med* 2010; 7: 399–408.
89. Cramer H, Lauche R, Langhorst J, Dobos G. Effectiveness of yoga for menopausal symptoms: a systematic review and meta-analysis of randomized controlled trials. *Evid Based Complement Alternat Med* 2012; 2012: 863905.
90. Posadzki P, Ernst E, Terry R, Lee MS. Is yoga effective for pain? A systematic review of randomized clinical trials. *Complement Ther Med* 2011; 19: 281–87.
91. Posadzki P, Ernst E. Yoga for low back pain: a systematic review of randomized clinical trials. *Clin Rheumatol* 2011; 30: 1257–62.
92. Sherman KJ, Cherkin DC, Wellman RD, et al. A randomized trial comparing yoga, stretching, and a self-care book for chronic low back pain. *Arch Intern Med* 2011; 171: 2019–26.
93. Tilbrook HE, Cox H, Hewitt CE et al. Yoga for chronic low back pain: a randomized trial. *Annals of Internal Medicine* 2011; 155: 569–78.
94. Tsauo JY, Lin KY, Hu YT, Chang KJ, Lin HF. Effects of Yoga on psychological health, quality of life, and physical health of patients with cancer: a meta-analysis. *Evidence-Based Complementary and Alternative Medicine* 2011; 2011: 659876.
95. Smith KB, Pukall CF. An evidence-based review of Yoga as a complementary intervention for patients with cancer. *Psychology* 2009; 18: 465–75.
96. Kochupillai V, Kumar P, Singh D, et al. Effect of rhythmic breathing (Sudarshan Kriya and Pranayam) on immune functions and tobacco addiction. *Ann N Y Acad Sci* 2005; 1056: 242–52.
97. Buffart LM, van Uffelen JG, Riphagen I, Brug J, van Mechelen W, Brown WJ, Chinapaw MJ. Physical and psychosocial benefits of Yoga in cancer patients and survivors, a systematic review and metaanalysis of randomized controlled trials. *BMC Cancer* 2012; 12: 559.
98. Beddoe AE, Paul Yang CP, Kennedy HP, Weiss SJ, Lee KA. The effects of mindfulness-based Yoga during pregnancy on maternal psychological and physical distress. *J ObstetGynecol Neonatal Nurs* 2009; 38:310-19.
99. Sun YC, Hung YC, Chang Y, Kuo SC. Effects of a prenatal Yoga programme on the discomforts of pregnancy and maternal childbirth self-efficacy in Taiwan. *Midwifery* 2009; 2: 24.
100. Satyapriya M, Nagendra HR, Nagarathna R, Padmalatha V. Effect of integrated Yoga on stress and heart rate variability in pregnant women. *Int J Gynaecol Obstet* 2009; 104: 218–22.
101. Chuntharapat S, Petpichetchian W, Hatthakit U. Yoga during pregnancy: effects on maternal comfort, labor pain and birth outcomes. *Complement TherClinPract* 2008; 14: 105–15.
102. Narendran S, Nagarathna R, Narendran V, Gunasheela S, Nagendra HR. Efficacy of Yoga on pregnancy outcome. *J Altern Complement Med* 2005; 11: 237–44.
103. Field T. Pregnancy and labor alternative therapy research. *AlternTher Health Med* 2008; 14: 28–34.
104. Birdee GS, Yeh GY, Wayne PM, Phillips RS, Davis RB, Gardiner P. Clinical Applications of Yoga for the Pediatric Population: A Systematic Review. *Acad Pediatr* 2009 ; 9: 212–20.
105. Galantino ML, Galbavy R, Quinn L. Therapeutic effects of yoga for children: a systematic review of the literature. *Pediatr Phys Ther* 2008; 20 : 66–80.
106. Büssing A, Michalsen A, Khalsa SB, Telles S, Sherman KJ. Effects of Yoga on mental and physical health: a short summary of reviews. *Evid Based Complement Alternat Med* 2012; 2012: 165410.