

Exploring the pharmacological and pharmacotherapeutic effects of yoga

Subramani Parasuraman¹, Lim Ee Wen¹, Khor Ming Zhen¹, Chin Kean Hean¹ and Aaseer Thamby Sam²

Units of ¹Pharmacology and ²Pharmacy Practice, Faculty of Pharmacy, AIMST University, Bedong 08100, Kedah, Malaysia.

ABSTRACT

Yoga is a spiritual technique incorporating a wide variety of practices, whose goal is developing a state of mental and physical health, well-being, inner harmony and ultimately, achieving a state of oneness with the universe. Yoga can modify disease state(s) and pave the way for a healthy life. Many systemic disorders are associated with/ due to stress. Regular yoga practice may improve the adaptive autonomic response(s) to stress. Yoga can be used as supportive or complementary therapy in conjunction with medical therapy for the treatment of any systemic disorder. Recent studies have showed the beneficial effects of yoga on the management/ treatment of diabetes, blood pressure, artherosclerosis etc. The main objective of this review is to summarize the phar-

macological aspects, medical and health benefits of yoga.

Key words: GABA, Meditation, Mental health, Yoga.

Address for Correspondence:

Dr. S. Parasuraman, Unit of Pharmacology, Faculty of Pharmacy,
AIMST University, Bedong 08100, Kedah, Malaysia.

Email: parasuraman@aimst.edu.my

DOI :10.5530/PTB.2016.1.2

INTRODUCTION

Yoga is a 5000-year-old Indian philosophical and spiritual technique aimed to integrate the body, mind and spirit, to achieve a state of oneness with the universe. The word yoga means 'union', and is derived from the Sanskrit word 'Yuj' referring to the union of the individual and the Divine. Yoga sutra written by Sage Patanjali is a guidebook that provides inspiration for present yoga practices. The yoga of patanjali is 'Ashtanga', comprising of 8 limbs such as *Yama* (ethical restraints), *Niyama* (spiritual observances), *Asana* (posture), *Pranayama* (breathing), *Pratyashara* (withdrawal of senses), *Dharana* (concentration), *Dhyana* (meditation) and *Samadhi* (absorbtion).¹ Yoga is one of the six major orthodox schools of Hinduism and helps to reduce the risk factors for metabolic syndromes and psychological illness.²⁻⁴ Hatha yoga and Rāja yoga, two different branches of yoga are believed to have originated in the early (time period) on the Indian subcontinent and have been practiced historically in India and throughout East Asia.

Yoga is a practical discipline incorporating a wide variety of practices whose goal is the development of a state of mental and physical health, well-being, inner harmony and ultimately 'a union of the human individual with the universal and transcendent existence'.^{5,6} Concept of yoga practice therapy become popular in the 20th century and consisted of five-principles, such as relaxation, exercise, breathing, proper diet, positive thinking and meditation.

Practicing yoga can trigger deep and fundamental shifts in the way our brain functions, and these shifts improve a person's mood, and reduces or banishes anxiety and depression in remarkable ways.^{7,8} Stress is an unpleasant feeling of distress and a common risk factor for development of many diseases like coronary heart disease, obesity and other metabolic syndromes.⁹⁻¹¹ Stress may be managed by progressive muscle relaxation, autogenic training, relaxation response, biofeedback, emotional freedom technique, guided imagery, diaphragmatic breathing, transcendental meditation, cognitive behavioral therapy, mindfulness-based stress reduction and emotional freedom technique. Yoga, can also be used to manage physical and mental stress.^{8,12} Yoga employs stable postures or *asanas* and *pranayama* (breathing control) which help to slow the progress of many diseases. The main objective of this review is to summarize the pharmacological aspect of yoga to manage systemic disorders.

PHARMACOLOGICAL ASPECT OF YOGA

Genes and brain: Stress and its associated health hazards like inflammation, disease, poor sleep are countered by our body's built-in 'relaxation response'. A study from Harvard Medical School and Massachusetts General Hospital has shown that yoga is a great way to stimulate the relaxation response.^{13,14} Yoga enhances and triggers the activity of genes involved in controlling energy metabolism, cell functions, blood sugar levels and tolerance maintenance. A lot of researches have linked long, healthy telomeres (telomeres are the caps at the chromosomes end that protect the important genetic material inside them) to lower rates of disease and death. Thus, the Harvard-Mass General study suggests that by protecting the telomeres, practicing yoga may help ward off disease and sickness.¹⁵

Gamma-Aminobutyric Acid: Gamma-aminobutyric acid (GABA) is a type of receptor in the brain which contributes to mood and anxiety disorders. When the brain's GABA activity drops, mood tends to sour and feels more anxious.¹⁶ Streeter *et al.*, studied the effect of yoga on anxiety in healthy adults. They educated respondents to yoga for 60 min, 3 times a week for 12 weeks and found that regular yoga practice had beneficial effects to manage stress/ anxiety. Regular yoga practice increases thalamic GABA levels and improves mood and decreased anxiety.¹⁷ In another study, Streeter *et al.*, found that among experienced yogis, activity of GABA leapt 27 percent after an hour long yoga session. To explore whether physical activity was the main factor for an increase in GABA activity, the study team compared practicing yoga to walking indoor on a treadmill. The results revealed yoga practitioners showed a greater GABA activity compared to respondents performing normal physical activity. The study also showed that yogis were observed to be in a brighter mood and less anxious than the walkers.¹⁸ The above study findings indicate that yoga can boost the GABA levels in the brain, and eventually, decreases the sourness of mood and anxiousness. Yoga not only reduces stress, it also improves neural performance and higher critical fusion frequency.¹⁹

Body-Mind Connection: Yoga is a form of mind-body fitness producing a physiological state opposite to that of the fight-or-flight stress response. It promotes strength, endurance, flexibility, and facilitates characteristics of friendliness, compassion, and greater self-control, while cultivating a sense of calmness and well-being.²⁰ The postures practiced in yoga assist

in balancing the autonomic nervous system. This allows the body to be less 'reactive' to changes in stress levels, or even vigorous exercise, resulting in a calmer, less anxious physiological environment.^{21,22} In a study investigating physiological changes after three months of yoga training, investigators found that practicing yoga resulted in decreased autonomic arousal and more psycho-physiological relaxation (heart rate and respiratory rate reduction) in 40 physical education teachers.²³ D'souza and Avadhany studied the effect of yoga on physical performance and found yoga practice improved physical performance largely by the increase in the respiratory muscle strength.²⁴ Hatha Yoga as a therapy is found to decrease resting blood pressure, increase parasympathetic tone, reduce physiological and psychological response to treat and improve baroreflex function/sensitivity. These are all indications of the body's improvement in regulating reactions through the autonomic nervous system.²⁵ Yoga is highly effective in dealing with psychosomatic complaints and enhancing the feelings one may have of well-being.

Studies revealed that six months of yogic practice lead to enhancement of parasympathetic activities, provided stability of autonomic balance during stress, produced a relative hyper metabolic state, improved thermoregulation efficiency, body flexibility, physical efficiency at sub maximal level of work, improved adaptability to environmental stress and cognitive function such as concentration, memory, learning efficiency and vigilance.²⁶

PHARMACOTHERAPEUTIC ASPECTS OF YOGA

Yoga for Depression: Anxiety and depression are very common and many seek treatment with alternative therapies such as meditation and yoga. Symptoms of clinical depression are increasingly relieved by practicing yoga. Together with the prescribed pharmaceuticals or recommended psychotherapy by physicians, yoga can help in quieting restless minds and connects a person with their inner source of calm and joy.^{27,28} Yoga therapy helps in guiding a person towards a calm, balanced and mindful mental state, often referred to as *sattva*.

Clinical depression is most commonly characterized by lethargic or agitated states. Use of energetic poses and calming practices is used to prevent lethargy (*tamas*) and anxiety (*rajas*).²⁹ In a Japanese sample of people, 90 minutes of yoga practice for a month decreased salivary amylase activity. This may be due to reduction in sympathetic response which is responsible for development of anxiety.³⁰ In another repeated measures study, Harner *et al.*, studied the influence of yoga on mental health among incarcerated women. From the study, the author concluded that yoga practice may decrease the symptoms of depression over time.³¹

Yoga for Post-traumatic Stress Disorder: Recent studies show that yoga can provide relief and relaxation in people suffering from post-traumatic stress disorder (PTSD) or emotional trauma, through working with their body as well as their mind. For instance, yoga for PTSD has been gaining a lot of attraction as a form of therapy for active-duty militaries. Telles *et al.*, studied the effect of yoga practice on PTSD and cardiac functions in Bihar (India) flood survivors and they found reduced sadness (Visual analog scales; P<0.05) in the yoga practice group and increased anxiety (P<0.05) in the non-yoga group. However, no statistical difference was observed in heart rates in yoga and non-yoga group, and this may be influenced by the duration of practice.³² Descilo *et al.*, studied the effect of yoga alone and with an exposure therapy for Post-traumatic stress disorder (PTSD) in survivors of South-East Asia tsunami and found yoga alone has better effect than yoga with an exposure group.³³ Staples *et al.*, also suggested that yoga program is an effective adjunctive therapy for improving hyperarousal symptoms such as difficulty sleeping and concentrating, irritability, anger, agitation, panic, and hypervigilance of PTSD.³⁴

Yoga for Medical Conditions: Yoga has been widely known to increase strength, flexibility and balance in practitioners. Newer research also found that yoga can be used to lower blood sugar and cholesterol levels, enhance the body's immune function, improve psychological well-being and lower stress levels.^{35,36} Studies have shown the effectiveness of yoga practice in treating medical conditions such as back pain, insomnia, multiple sclerosis, cancer, heart disease and tuberculosis. Yoga is useful in overcoming pain or limitations in patients suffering from the above medical conditions.³⁷⁻³⁹

Breathing issues are improved by practicing slow, deep and mindful breathing. Stress levels and heart rate can be lowered with quiet *asanas*, together with breathing and meditation exercises. Yoga improves the quality of life of patients suffering from various medical conditions.

For Injuries: Yoga is a brilliant therapy for injuries (recent or chronic, mild or serious). Yoga does not just ease pain, but it also teaches the patients to prevent future injuries. Poses for yoga differs according to the severity of injuries. Yoga is most commonly used for lower back pain, knees, wrists and shoulders. Yoga helps in improving body blood flow, encourages muscle movements, and thus, shortens healing time.

For Osteoporosis: It is well known that weight bearing is essential in the fight against the onset of osteoporosis and osteopenia. Yoga is an excellent means of achieving weight bearing through both upper and lower body joints, with minimal impact. A trained instructor would emphasize to clients with osteoporosis to avoid lots of flexion movements and incorporate extension. Loren, studied the effect of yoga and concluded that yoga appears to be an effective way to build bone mineral density after menopause.⁴⁰ Sinaki, and Tüzün *et al.*, also concluded that yoga is an alternative physical activity for the treatment of osteopenia and osteoporosis.^{41,42}

For Musculoskeletal Impairments: Yoga's use of static postures and transitional movements in multi-planar patterns with full body participation can aid in improving many musculoskeletal problems and frailty issues due to its ability to strengthen and stretch the muscles.

For Asthma: Many studies indicate the benefits of yoga for mild to moderate asthma. Research has demonstrated improved lung function, overall fitness and airway sensitivity, and decreased need for asthma medications.⁴³ Clinical studies showed that regular yoga practice may reduce bronchoconstriction and improve the respiratory function, sympathovagal balance and quality of life.¹⁹

For Cardiovascular Diseases: A few studies suggested that people with heart disease who practice yoga may have decreased angina risk.^{44,45} Yoga decreases the risk factors for heart diseases such as high blood pressure, cholesterol and blood sugar levels. A three-month residential study treating patients with yoga, meditation and a vegetarian diet at Hanover Medical University in Germany, found a substantial reduction in risk factors including blood pressure and cholesterol in patients.⁴⁶

Health Benefits of Yoga

Immunity Booster: Yoga practice results in changes in gene expression that aids in boosting immunity at cellular level. A recent Norwegian study shows that such occurrence doesn't take long to happen as the researchers believe that changes occur when participants were still on the mat. The effects were significantly greater than a control group going on a nature hike while listening to soothing music. Yoga teachers also mention that by increasing overall health, immunity level was boosted together.⁴⁷

Ease Migraines: A study conducted amongst migraine sufferers, showed that they suffer from fewer and less painful migraines after three months of yoga practice. However, the cause of migraines isn't fully understood and remains mysterious to a certain extent till date. It is said that the

cause might be a combination of mental stressors and physical misalignment, resulting in migraines and other issues. For instance, the simple action of hunching over a computer or cell phone with shoulders up and head forward causes over lifting of trapezius and tightening of the neck. This pulls the head forwards and creates a muscle imbalance leading to contribution of headaches and migraines.^{48,49}

Builds muscle strength: Strong muscles provide more than just aesthetic looks. They also protect the body from conditions like arthritis and back pain, and help prevent falls in elderly people. When core strength building is done through yoga, a balance of strength with flexibility is achieved, compared to just going to the gym and lifting weights, wherein strength building is achieved at the expense of flexibility. Sinaki, studied the effect of yoga on three healthy persons with low bone mass or fracture and found that yoga exercises improved their musculoskeletal health.^{41,50}

Prevents cartilage and joints breakdown: The joints are taken through their full range of motion each time yoga is practiced. This can help prevent the development of arthritis/ mitigate disability by 'squeezing and soaking' area of cartilage.⁵⁰

Increases blood flow and heart rate: Yoga helps to increase the blood flow more specifically during relaxation exercises, and also regulate the cardiac muscles' contractility, which in turn helps to lower the risk of heart attacks and aids in relieving depression. Yoga also improves oxygen supply to cells, resulting in better functioning body cells.²⁰

Twisting poses and inverted poses help a lot when there is swelling in the legs due to heart or kidney problems. Yoga on the other hand, boosts levels of hemoglobin and red blood cells in the blood, which carry oxygen to the tissues. Platelets are made less sticky which thins the blood, and by cutting the level of clot-promoting proteins in the blood, yoga practice can decrease atherosclerosis, heart attacks and strokes.⁵¹ Bernardi *et al.*, also reported the favorable cardiovascular effect of yoga practice, and concluded that yoga causes striking, powerful and synchronous increase in existing cardiovascular rhythms and slow breathing increases the arterial baroreflex sensitivity.⁵²

Lowers blood sugar: Yoga helps to regulate glycemic control and lipoproteins level. In diabetics, yoga has been found to lower blood sugar in several ways: by encouraging weight loss, lowering cortisol and adrenaline levels, and improving the body's sensitivity to insulin's effects.⁵³ By

lowering blood sugar levels, the risk of developing diabetic complications such as heart attack, kidney failure, and blindness are also reduced. In many studies, regular yoga exercise showed beneficial glycemic control in diabetic patients, pregnant women and improved adaptive autonomic response to stress.^{54,55}

Improves balance and focus: Regularly practicing yoga increases the ability to perceive the position of our body, the actions our body is involved in, which in turn improves balance and ability of focusing. Regular yoga practice improves coordination and memory power with better recall information.⁵⁶

Aids in Weight Loss: The obesity epidemic is a gargantuan problem affecting millions worldwide. There are many possible healthy long-term approaches to weight loss. The first and most effective approach that deals with underlying causes, is to eat healthy nutrient dense organic foods. Another solution is yoga.⁵⁷

Yoga stimulates the vital force of the liver. The liver has a lot of crucial functions. It acts as an extremely strong cleanser and detoxifier. By practising certain yoga postures, the vital force of the liver is strengthened in profound ways that brings it to optimum functional status. Hypothyroidism is also a factor that causes weight gain, and this can be modulated by yoga. Singh *et al.*, suggested that yoga can be used as a supportive or complementary therapy in conjunction with medical therapy, for the treatment of hypothyroid disorder, which may improve the quality of the life of the affected patients.⁵⁸

Prenatal Yoga: Practicing yoga by pregnant women is an excellent form of exercise which benefits both the mother and the baby due to the strengthening, stretching, breathing practice, meditation and relaxation yoga. Yoga practice can easily be adjusted for the different trimesters during the gestation period. Further, the intensity of yoga practice can be increased or decreased depending on the pregnant woman's energy levels. Despite being called 'prenatal yoga', this particular type of yoga can also be a great tool for women who are trying to conceive, because it allows the practitioner a 'stress-free' break for her body, which helps and supports the process of reproduction.

Some Common Misconceptions of Yoga

Some of the common misconceptions about yoga persist even today. Table 1, depicts some of them and the established facts.

Table 1: Misconceptions and facts of Yoga

Misconceptions	Facts
Flexibility is important to do yoga	Yoga improves the flexibility of an individual. However, it is not a criterion that one has to be flexible to practice yoga.
Weight loss is a must before starting yoga exercises	Anyone can practise yoga. Yoga will help one to feel more energetic. Overall muscle toning is one of the end results.
Yoga is a low impact exercise	Some people think that yoga is not challenging and ranks low as a cardiovascular workout. However, depending on the yoga class, it can be quite rigorous.
Females cannot do yoga during their menstrual periods	Practicing yoga is a great way to prevent and stop menstrual cramps. It relaxes and rejuvenates the mind to take the edge off any mood swings women may experience. Centering and breathing exercises as well as practising grounding poses are recommended. It is advisable to avoid postures, which require inversions during your menstrual period as it will tax your overall system. ⁵⁹
Yoga just involves stretching of the body	There's a great deal of value in gentle yoga, but there are many styles and schools of yoga that are incredibly physically challenging. It takes strength, stamina, and flexibility.
Yoga is merely another form of basic exercise.	Yoga is the joining of the mind, body, and spirit. It's an inner peace and union with the environment by means of quieting the constant chatter of the mind, creating a healthy body, and being at peace with who you are and the world around you. This harmony is achieved by following certain guidelines like the <i>Yoga Sutra</i> .
Being a vegetarian is a must for yoga practitioners.	One of the <i>yamas</i> , or guidelines, of a yogic lifestyle is <i>ahimsa</i> , or non-harming, which is commonly interpreted to include non-violence toward animals. On the other hand, there are many who say that <i>ahimsa</i> includes not inflicting violence upon oneself as well, and that certain individuals may need to include meat in their diets for health reasons. In these cases it could be argued that denying the body the necessary nutrients that come from meat would be a form of harming. In the end, whether or not to eat meat is a personal choice that most practitioners inevitably experiment with. ⁶⁰

Only the super-fit people can practice yoga.

It conflicts with religious beliefs of many people.

Yoga accepts individuals regardless of any barrier. There are no rules, no expectations, and no judgments. Anyone can benefit from the practice of yoga as long as she or he is patient and approaches the practice with an open mind.

It's true that in some yoga studios, one might see a statue of the Hindu deity Shiva and hear some chanting. The Hindu references are merely traditions passed down from teacher to teacher, not a religious practice. No yogic teacher or master has ever pushed any religion on anyone during a yoga class.⁶¹

CONCLUSION

Yoga is not a religious programme. It is a spiritual technique aimed at integrating the body, mind and spirit, to achieve a state of oneness with the universe. Regular yoga practice can improve the quality of the life and reduce stress factors which induce or aggravate a plethora of deadly diseases. No matter your physical, spiritual, or dietary background, there is a form of yoga out there for you! Commit to your practice and allow yourself time to experiment with the different styles.

REFERENCES

1. Batcheller LJ. Introduction to Yoga. Available in <http://www.kripalu.org/article/253/>. [Last accessed on 04-07-2015].
2. Laurah Klepinger-Mathew. The Spirit and Meaning of Globalized Yoga: a Case Study on the Sivananda Yoga Vedanta Centres. Available in http://globalsouthasia.syr.edu/wp-content/uploads/2014/06/KlepingerMathew_Yoga1.pdf. Last accessed on 04-07-2015. [Last accessed on 04-07-2015].
3. Smith KB, Pukall CF. An evidence-based review of yoga as a complementary intervention for patients with cancer. *Psycho-oncology*. 2009; 18(5): 465-75.
4. Vancampfort SD, Vansteelandt K, Scheewe T, Probst M, Knapen J, De Herdt A, De Hert M. Yoga in schizophrenia: a systematic review of randomised controlled trials. *Acta Psychiatr Scand*. 2012; 126(1): 12-20.
5. Khalsa SB. Yoga as a therapeutic intervention. A Bibliometric Analysis of Published Research Studies. *Indian J Physiol Pharmacol*. 2004; 48(3): 269-85.
6. Khalsa, SB. Yoga as a therapeutic intervention In Principles and Practice of Stress Management. Ed. Lehrer PM, Woolfolk, Sime WE. 3rd edition, Guilford Press, New York, 2007. pp. 449.
7. Raub JA. Psychophysiological effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: a literature review. *J Altern Complement Med*. 2002; 8(6): 797-812.
8. Sengupta P. Health Impacts of Yoga and Pranayama: A State-of-the-Art Review. *Int J Prev Med*. 2012; 3(7): 444-58.
9. Sinha R, Jastreboff AM. Stress as a common risk factor for obesity and addiction. *Biol Psychiatry*. 2013; 73(9): 827-35.
10. Weiss T, Skelton K, Phifer J, Jovanovic T, Gillespie CF, Smith A, et al. Posttraumatic stress disorder is a risk factor for metabolic syndrome in an impoverished urban population. *Gen Hosp Psychiatry*. 2011; 33(2): 135-42.
11. Kivimäki M, Nyberg ST, Batty GD, Fransson EI, Heikkilä K, Alfredsson L. Job strain as a risk factor for coronary heart disease: a collaborative meta-analysis of individual participant data. *Lancet*. 2012; 380(9852): 1491-7.
12. Varvogli L, Darviri C. Stress Management Techniques: evidence-based procedures that reduce stress and promote health. *Health Science Journal*. 2011; 5(2): 74-89.
13. Dusek JA, Otu HH, Wohlhueter AL, Bhasin M, Zerbini LF, Joseph MG, Benson H, Libermann TA. Genomic counter-stress changes induced by the relaxation response. *PLoS One*. 2008; 3(7): e2576.
14. Tindle HA, Davis RB, Phillips RS, Eisenberg DM. Trends in use of complementary and alternative medicine by US adults: 1997-2002. *Altern Ther Health Med*. 2005; 11(1): 42-9.
15. Your Brain: On Yoga. Available in <http://bensonhenryinstitute.org/news-and-events/news/151-your-brain-on-yoga> [Last accessed on 16/07/2015].
16. Rägo L, Kiivet RA, Harro J, Pöld M. Behavioral differences in an elevated plus-maze: correlation between anxiety and decreased number of GABA and benzodiazepine receptors in mouse cerebral cortex. *Naunyn Schmiedebergs Arch Pharmacol*. 1988; 337(6): 675-8.
17. Streeter CC, Whitfield TH, Owen L, Rein T, Karri SK, Yakhkind A, 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(11): 1145-52.
18. Streeter CC, Jensen JE, Perlmuter RM, Cabral HJ, Tian H, Terhune DB, Ciraulo DA, Renshaw PF. Yoga Asana sessions increase brain GABA levels: a pilot study. *J Altern Complement Med*. 2007; 13(4): 419-26.
19. Balaji PA, Varne SR, Ali SS. Physiological effects of yogic practices and transcendental meditation in health and disease. *N Am J Med Sci*. 2012; 4(10): 442-8.
20. Woodyard C. Exploring the therapeutic effects of yoga and its ability to increase quality of life. *Int J Yoga*. 2011; 4(2): 49-54.
21. Noor S, Prasad KVS, Krishnababu G. Yoga-Its awareness and benefits on health. *J Evol Med Dent Sci*. 2015; 4: 6248-56.
22. Kub C. Health benefits of the Yoga. Available in <https://www.yogafit.com/research/healthbenefits.doc> [Last accessed on 17/07/2015]
23. Telles S, Nagarathna R, Nagendra HR, Desiraju T. Physiological changes in sports teachers following 3 months of training in Yoga. *Indian J Med Sci*. 1993; 47: 235-8.
24. D'souza C, Avadhany ST. Effects of yoga training and detraining on physical performance measures in prepubertal children – a randomized trial. *Indian J Physiol Pharmacol* 2014; 58(1): 61-8.
25. Gard T, Noggle JJ, Park CL, Vago DR, Wilson A. Potential self-regulatory mechanisms of yoga for psychological health. *Front Hum Neurosci*. 2014; 8: 770.
26. Ayurveda, Siddha, Unani, Homeopathy, Yoga & Naturopathy systems of Medicine in India – A Booklet, Published by Department Of Indian System of Medicine & Homeopathy, (now renamed as AYUSH) Ministry of Health & Family Welfare, Government of India, New Delhi.
27. Saeed SA, Antonacci DJ, Bloch RM. Exercise, yoga, and meditation for depressive and anxiety disorders. *Am Fam Physician*. 2010; 81(8): 981-6.
28. 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.
29. Drayer G, Doherty K. *Yoga and Grief: a compassionate journey toward healing*. Balboa Press, Bloomington, 2014.
30. Gururaja D, Harano K, Toyotake I, Kobayashi H. Effect of yoga on mental health: Comparative study between young and senior subjects in Japan. *Int J Yoga*. 2011; 4(1): 7-12.
31. Harner H, Hanlon AL, Garfinkel M. Effect of Iyengar yoga on mental health of incarcerated women: a feasibility study. *Nurs Res*. 2010; 59(6): 389-99.
32. Telles S, Singh N, Joshi M, Balkrishna A. Post traumatic stress symptoms and heart rate variability in Bihar flood survivors following yoga: a randomized controlled study. *BMC Psychiatry*. 2010; 10(1): 18.
33. Descilo T, Vedamurtachar A, Gerbarg PL, Nagaraja D, Gangadhar BN, Damodaran B, et al. Effects of a yoga breath intervention alone and in combination with an exposure therapy for post-traumatic stress disorder and depression in survivors of the 2004 South-East Asia tsunami. *Acta Psychiatr Scand*. 2010; 121(4): 289-300.
34. Staples JK, Hamilton MF, Uddo M. A yoga program for the symptoms of post-traumatic stress disorder in veterans. *Mil Med*. 2013; 178(8): 854-60.
35. Mondal S, Kundu B, Saha S. Blood sugar and lipid profile adaptations to yoga therapy. *J Yoga Phys Ther*. 2014; 4(4): 175.
36. Rai S, Julka K, Chaorasia RS. Comparison of effect of yoga on fasting blood sugar level, lipid profile and blood pressure in diabetes patient with addiction and without addiction. *Int J Med Sci Res Pract*. 2015; 2(2): 99-101.
37. Antezana A. Symptomatic management of multiple sclerosis. *Neurol Rep*, 2014; 7: 39-46.
38. Mooventhiran A, Khode V, Nivethitha L. Effect of yogic breathing techniques in new sputum positive pulmonary tuberculosis. *Int J Prev Med*. 2014; 5(6): 787-90.
39. Mustian KM, Sprod LK, Janelsins M, Peppone LJ, Palesh OG, Chandwani K, et al. Multicenter, randomized controlled trial of yoga for sleep quality among cancer survivors. *J Clin Oncol*. 2013; 31(26): 3233-41.
40. Fishman LM. Yoga for Osteoporosis: A Pilot Study. *Top Geriatr Rehabil*. 2009; 25(3): 244-50.
41. Sinaki M. Yoga spinal flexion positions and vertebral compression fracture in osteopenia or osteoporosis of spine: case series. *Pain Pract*. 2013; 13(1): 68-75.
42. Tüzün S, Aktas I, Akarirmak U, Sipahi S, Tüzün F. Yoga might be an alternative training for the quality of life and balance in postmenopausal osteoporosis. *Eur J Phys Rehabil Med*. 2010; 46(1): 69-72.
43. Mandanmohan, Jatiya L, Udupa K, Bhavanani AB. Effect of yoga training on handgrip, respiratory pressures and pulmonary function. *Indian J Physiol Pharmacol*. 2003; 47(4): 387-92.
44. Mahajan AS, Reddy KS, Sachdeva U. Lipid profile of coronary risk subjects following yogic lifestyle intervention. *Indian Heart J*. 1999; 51(1): 37-40.
45. Manchanda SC, Narang R, Reddy KS, Sachdeva U, Prabhakaran D, Dharmanand S, Rajani M, Bijlani R. Retardation of coronary atherosclerosis with yoga lifestyle intervention. *J Assoc Physicians India*. 2000; 48(7): 687-94.
46. Schmidt T, Wijga A, Von ZurMühlen 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.
47. Qu S, Olafsrud SM, Meza-Zepeda LA, Saatcioglu F. Rapid gene expression changes in peripheral blood lymphocytes upon practice of a comprehensive yoga program. *PLoS One.* 2013; 8(4): e61910.
 48. Kisan R, Sujan M, Adoor M, Rao R, Nalini A, Kutty BM, *et al.* Effect of Yoga on migraine: A comprehensive study using clinical profile and cardiac autonomic functions. *Int J Yoga.* 2014; 7(2): 126-32.
 49. Domonell, K.(2013) 5 Surprising Health Benefits of Yoga. Available at <http://daily-burn.com/life/fitness/health-benefits-yoga/> [Last accessed on 23/4/2015].
 50. McCall, T. (2007). 38 Health Benefits of Yoga. Available at <http://www.yogajournal.com/article/health/count-yoga-38-ways-yoga-keeps-fit/>[Last accessed on 23/4/2015].
 51. Benefits of Yoga. Available in <http://butterfly-yoga.com/benefits-of-yoga/>[Last accessed on 23/4/2015].
 52. Bernardi L, Sleight P, Bandinelli G, Cencetti S, Fattorini L, Wdowczyk-Szulc J, Lagi A. Effect of rosary prayer and yoga mantras on autonomic cardiovascular rhythms: comparative study. *BMJ.* 2001; 323(7327): 1446-9.
 53. Singh S, Malhotra V, Singh KP, Madhu SV, Tandon OP. Role of yoga in modifying certain cardiovascular functions in type 2 diabetic patients. *J Assoc Physicians India* 2014; 52: 203-306.
 54. Chimkode SM, Kumaran SD, Kanhere WV, Shivanna R. Effect of yoga on blood glucose levels in patients with Type 2 diabetes mellitus. *J Clin Diagn Res.* 2015; 9: CC01-3.
 55. 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.
 56. Diamond A, Lee K. Interventions shown to aid executive function development in children 4 to 12 years old. *Science.* 2011; 333(6045): 959-64.
 57. Narayani U, Paul Rao SRL, Effect of aerobic training of percentage of body fat, total cholesterol and HDL-C among obese women. *World J of Sport Sci.* 2010; 3(1): 33-36.
 58. Singh P, Singh B, Dave R, Udainiya R. The impact of yoga upon female patients suffering from hypothyroidism. *Complement Ther Clin Pract.* 2011; 17(3): 132-4.
 59. Yoga misconceptions. Available in www.trueyoga.com.sg/faq/yoga-misconceptions [Last accessed on 20/10/2015].
 60. 3 Common misconceptions about yoga. Available in www.yogainternational.com/article/view/3-common-misconceptions-about-yoga [Last accessed on 20/10/2015].
 61. 5 Biggest misconceptions about yoga. Available in www.yogajournal.com/uncategorized/5-biggest-misconceptions-about-yoga/ [Last accessed on 20/10/2015].