Expert Opinion

Role of yoga in health and disease

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Abstract

Yoga as a mode of therapy 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. 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. This review paper details some of the health promoting benefits of yoga as well as discusses the important cardiovascular, respiratory, musculoskeletal and metabolic conditions in which it may have preventive, supportive, curative and rehabilitative potential. Role of yoga in stress, mental health, cancer, pregnancy and childhood are also detailed. Mechanisms for such beneficial physiological, biochemical and psychological effects are discussed. Psycho-neuro-endocrine changes including correction of GABAergic activity, and parasympathetic activation coupled with decreased reactivity of sympathoadrenal system and HPA axis are highlighted. Changes in the various evaluated parameters for different conditions are detailed and discussed with ample references. Though most studies and reviews suggest a number of areas where yoga may be beneficial, 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 consider that the proper studies on yoga as a therapeutic modality are not older than a few decades. It is important to develop objective measures of various mind-body therapies and their techniques while including them in intervention trials. An overview is given of the lacunae present in the reviewed studies and suggestions given for improvements in future studies. In conclusion, we can say that yoga has preventive, promotive as well as curative potential and that a yogic lifestyle confers many advantages to the practitioner. Since lifestyle related diseases are alarmingly on the rise in our modern society, yogic lifestyle that is cost effective and relatively safe, should be given a special place in preventing and managing these diseases.

Keywords: health; disease; stress; yoga therapy.

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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.

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) 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" [1].

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 [2]: "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 [3]. 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 [4].

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.

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.

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

1. *Improvement in cardio-respiratory efficiency [5–8]*
2. *Improvement in exercise tolerance [9–12]*
3. *Harmonious balance of autonomic function [13–16]*
4. *Improvement in dexterity, strength, steadiness, stamina, flexibility, endurance, and neuro-musculo-skeletal [9, 17–22]*
5. *Increase in alpha rhythm, inter-hemispheric coherence and homogeneity in the brain [23–26]*
6. *Improved sleep quality [27]*
7. *Improved cognitive functions [5, 28–34]*

8. *Alteration in brain blood flow and brain metabolism [35–38]*
9. *Modulation of the neuro-endocrine axis [39–44]*

Managing Stress

It is well established that stress weakens our immune system. Scientific research in recent times has showed 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."[45] Reductions in perceived stress following yoga are reported to be as effective as therapies such as relaxation, cognitive behavioral therapy and dance therapy.

Mechanisms postulated included 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 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 comorbid medical conditions based on the concept that yoga practices reduce allostatic load in stress response systems such that optimal homeostasis is restored [46].

They hypothesized that stress induces 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 the intrinsic mechanisms behind such potential autonomic balancing effects of yoga [47]. Innes, *et al.* had earlier also 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[48].

Cardiovascular Conditions

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 [48]. Another literature review reported significant improvements in overall cardiovascular endurance of young subjects who were given varying periods of yoga training [49]. 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 [50].

Mental Health

Yoga can enhance one's spiritual life and perspective beyond the physical life regardless of one's particular religion [51]. It enables people to attain and maintain a balance between exertion and relaxation, and this produces a healthy and dynamic state of homeostatic equilibrium [1]. Recent studies have shown that yoga improves mood and reduces depression scores [52, 53]. These changes have been attributed to an increased secretion of thalamic GABA with greater capacity for emotional regulation [53, 54]. Even a 10-day yoga-based lifestyle modification program has been reported to improve subjective wellbeing scores of patients [16]. A review by Carim-Todd, *et al.* on yoga and smoking cessation, reported positive benefits of mind–body in-

terventions [55]. 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 the scarcity of papers, low quality of some publications, and the numerous limitations of the studies such as reduced sample size, limitations of study design, lack of adherence monitoring, lack of objective measures, inadequate or absent control conditions and absence of blinding.

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 [56]. Researchers also support the promising role of yoga as an intervention for depression because it the intervention is cost-effective and easy to implement [61]. 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 [57].

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 [58, 59]. Behera reported perceptible improvement in dyspnoea and lung function in patients of bronchitis after 4 weeks of yoga therapy that used a variety of postures and breathing techniques [60]. 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 [61]. A nonspecific broncho protective or broncho relaxing effect has been also postulated [62] while improved exercise tolerance has been reported following yoga therapy in patients of chronic severe airways obstruction [63]. 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 [64] and decreased chemoreflex sensitivity to hypoxia and hypercapnia [65]. 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 [66-69], as well as reduce sympathetic nervous system tone, increase vagal activity [70, 71], and elevate brain GABA levels [54]. 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 [48, 72]. 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 favorable effects of yoga on short-term parameters related to diabetes but not necessarily for long-term outcome [73]. 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 [45].

Musculoskeletal Conditions

A review by Posadzki, *et al.*[74] 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 [75]. Recently two well-designed trials of yoga for back pain reported clinically meaningful benefits over usual med-

ical care but not over an intensive stretching intervention [76, 77].

Cancer

According to the findings of a comprehensive meta-analysis of yoga in cancer, yoga groups showed improvements in psychological health when compared to waitlist or supportive therapy groups [78]. 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 [79]. 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 [80]. 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 [81]. 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 [82]. 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 [83]. 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 [84] while Chuntharapat, *et al.* [85] 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 [86]. 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.

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 [87]. 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" [88]. 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."

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 [89].

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 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.

Disclosure

There are no conflicts of interest.

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