Implication of yoga in noncommunicable diseases

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Abstract

The significance of yoga in health and disease is so extensive and of such a general nature that it has become a necessity for doctors who will be practicing in the current and the coming centuries. A positive attitude and a peaceful mind are conducive to healing and happiness, whatever may be the nature of disease or illness. The evidence generated has made modern medicine accept the love, peace, joy, positive thinking, relaxation, hope, etc., as therapeutic tools. This is how yoga becomes a potent instrument for influencing the mind positively. Based on the above traditional as well as scientific thinking, some of the noncommunicable diseases are mentioned in this article, for which yoga may be used with a favorable effect in modern medicine. The need of the current time is to have an integrated approach toward complete therapy and to utilize yoga therapy in harmonization, cooperation, and collaboration with other systems of medicine such as modern medicine, Ayurveda, and naturopathy. The main aims of the therapeutic implications of yoga should be to increase parasympathetic and decrease sympathetic activities. This enables us to move from a state of ill health and sickness to one of fitness and well-being.

Keywords: Non communicable disease, parasympathetic activity, sympathetic activity, yoga

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Received: 11.07.2016, **Accepted:** 11.07.2016

INTRODUCTION

It is said that yoga practice will reduce the risk of noncommunicable diseases (NCDs) including heart disease, diabetes, neurological disorder, and respiratory diseases. The significance of yoga in health and disease is so extensive and of such a general nature that it has become a necessity for doctors who will be practicing in the 21st century.^[1] A wide variety of common diseases such as coronary heart disease, hypertension, and diabetes mellitus (DM) are now being documented to a faulty lifestyle. Yoga is probably the best lifestyle ever devised in the history of humanity.^[1] It is a simple, devoted, compassionate way and view of life, upon which people

across cultures and across countries have stumbled for time to time for centuries. Yoga is finding an increasing approval as a nonpharmacological intervention for the prevention and treatment of diseases.^[1] Therefore, all the doctors should be well informed about yoga and how it impacts human body system so that doctors may provide sensible answers to patients about the fundamentals of yoga and its impact on health and diseases.^[2,3] A consultant with a yogic attitude is more likely to transmit to the patient a positive attitude and tranquil substantiation. A positive attitude and a peaceful mind are conducive to healing and happiness, whatever may be the nature of disease or illness.^[4]

Access this article online

Quick Response Code:

Website:

www.joshd.net

DOI:

10.4103/2321-0656.209314

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How to cite this article: Pandey AK, Das A. Implication of yoga in noncommunicable diseases. J Soc Health Diabetes 2017;5:88-93.

“Yoga can be adept everywhere by people of all age groups, irrespective of their socioeconomic status. It fits in very well with the healthy lifestyle that the WHO has been strongly advocating for throughout the life cycle – from childhood to healthy aging. The United Nation’s pronouncement to observe June 21 as the International Yoga Day is a gratitude of this ancient Indian practice which has become global. The Yoga Day will rightly put the spotlight on physical exercise, much needed in today’s world when sedentary lifestyle is becoming a leading cause of illness.” Emphasizing that the Indian subcontinent had a long history and rich tradition in conventional medicines and practices that contribute to health and wellness of the people, we can say that yoga was one of the finest traditional therapeutic systems in the ancient India.^[5]

“Yoga is believed to offer means for the actualization of human potential to perfection through its three-dimensional approach to health – physical, mental, and spiritual. Yoga is very much relevant even today – as it is both a physical activity and an effective way of managing stress,” and the world is fortunate that such conventional medical practices have survive over the centuries.^[5] Till few years back, yoga was considered an adjunct therapy in modern medicine. However, during the last decade, yoga has got incorporated in modern medicine.^[5] The diseases of modern civilization such as obesity, hypertension, DM, and coronary artery disease are rooted due to faulty lifestyle. This is a stimulus to search for a healthy lifestyle. Yoga is one of the best lifestyles ever devised by human beings.^[6] Psychological stress has a major impact on the diseases related to modern civilization. This is another stimulus to search for strategies for overcoming stress.^[6] Yoga provides a new way of looking at life. Stress, anger, hostility, relaxation, peace, love, emotion, and intimacy are difficult to measure, but it provides a solid scientific foundation of mind–body relationship and emergence of psychoneuroimmunology.^[7] All these cannot be measured, but their effect on body system can be quantified by measuring certain biomarkers such as cytokine levels or measurement of natural killer cells. Science demands quantifiable evidence. Providing evidence for the effects of emotions on biological features may prove to be a great relevance to the health and disease.^[8] The evidence generated has made modern medicine accept the love, peace, joy, positive thinking, relaxation, hope, etc., as therapeutic tools.^[9] This is how yoga becomes a potent instrument for influencing the mind positively.^[9] Based on the above traditional as well as scientific thinking, below are some of the NCDs, for which yoga may be used with a favorable effect in modern medicine.

YOGA IN OBESITY AND CARDIOVASCULAR DISEASE

Obesity is a state of mild or low-grade inflammation,^[10] which may later culminate in a chronic disorder if remains untreated. A number of inflammatory mediators have been shown to be released by adipose tissue, which acts as an endocrine organ with autocrine regulation.^[11] Several studies suggest that inflammation contributes to the causation and progression of cardiovascular disease (CVD).^[12,13] Further, inflammatory mediators may trigger rupture of the atherosclerotic plaque which may result in coronary thrombosis and ischemia [Figure 1].^[14] In spite of the considerable improvement in therapeutic modalities in CVD, an effective treatment leftover a challenge. The treatment modalities for weight reduction in the management of patients with CVD and those at an augmented risk are paying attention on nutritional interventions, increased physical activity, and pharmacological management.^[15,16] It has been stressed that weight reduction is the main contributor for the correction of deranged lipid profile,^[17] especially by reduction in abdominal fat.^[18] Recent studies have shown that lifestyle intervention is a promising option in patients with CVD as well as those at an increased risk of CVD.^[19] Therefore, lifestyle modifications aiming at weight reduction by physical activity, dietary changes, yogic exercises including breathing exercises, and stress relaxation have a very specific role in the management as well as in the prevention of cardiac diseases.^[20] Yoga combines a healthy lifestyle with mental peace, and a

Figure 1: Schematic diagram showing physiological basis of stress and stress-related disorders due to abnormal psycho-neuro-immuno-endocrine system, HPA: Hypothalamic-pituitary-adrenal axis

modification in lifestyle and calming practices is shown to improve the clinical profile of patients with various pathologies.^[8,9] Routine practice of breathing exercise and meditation in healthy individuals led to an improved cardiovascular metabolic status [Figure 1],^[21,22] even by a short-term yoga-based routine intervention.^[23] Notably, even short-term yoga-based broad lifestyle intervention led to a remarkable reduction in blood pressure (BP), body mass index, and blood glucose with a clinically significant improvement in lipid profile.^[24] A similar reduction in weight was observed in another study that included an 8-week of yoga training that resulted in an improvement in body composition and total cholesterol levels in obese adolescent boys.^[25] Long-term changes in lifestyle involving yogic exercises, stress reduction techniques, and fat-free vegetarian diet led to angiographically demonstrable reduction in coronary stenosis.^[26,27] Another study showed that Surya namaskar (a yoga posture) resulted in an improved cardio-respiratory fitness.^[28] Similarly, a yoga-based lifestyle intervention resulted in a reduction in all lipid profile parameters except high-density lipoprotein. The effect started from 4 weeks and lasted for 14 weeks.^[29] All these results indicate that a yogic lifestyle interference may have an effect on some adaptable risk factors, which could make clear the protective and therapeutic valuable impact of yoga in CVD. Overall, lifestyle intervention can transform the evolution of the CVD.

DIABETES MELLITUS

Abnormal increase in sympathetic activity and reduction in parasympathetic activity have been associated with Type 2 DM. Chronic stress, anxiety, and depression have already been implicated in pathogenesis as well as the aftermath of diabetes. Some studies have shown positive effects of yoga intervention on stress and anxiety.^[30] Studies and reviews have clearly shown the positive effects of yoga on glycemic control, BP, lipid profile, stress, anxiety, and depression, but have not identified the mechanisms of the action of yoga in Type 2 DM. Previous studies have clearly stated the need to review mechanisms by which yoga helps in diabetes.^[31]

Yoga practice is directly related to improved insulin sensitivity to glucose signals in Type 2 DM. It attenuates the negative relationship between factors causing insulin resistance such as obesity, increased waist circumference, and dyslipidemia.^[32] Yoga also improves the sensitivity of beta cells of pancreas to glucose signals. Manjunatha *et al.* have stated that there is reduction in the brisk release of insulin when glucose level tends to fall whereas there is an increased insulin release when glucose tends to rise in blood.^[33] This mechanism gets support from a previous

study of Sahay who observed a fall in fasting insulin level when glucose level is at a minimum level. Yoga optimizes insulin secretion as per bodily requirement through its neuro-endocrinal effects and thereby bringing about normalcy in the insulin/glucose ratio, which is suggestive of better peripheral utilization of insulin and reduced insulin resistance.^[34]

Yoga has been widely recommended for diabetes. A study by Sahay *et al.* deliberately dissected yoga into small components and studied each separately.^[35] Among the alternatives which reduced fasting and postprandial blood glucose were Pranayama, Dhanurasana + Ardha Matsyendrasana, Halasana + Vajrasana, and Naukasana + Bhujangasana. Further analysis revealed that Dhanurasana was the most effective asana for diabetes. A combination of mudra and salabhasana was ineffective, and produced a nonsignificant rise in fasting blood glucose in their study on five participants. This small number of participants and statistically nonsignificant rise in blood glucose make such a conclusion unwarranted.^[35]

It is not easy to recognize any lone physiologic mechanism of action of yoga in Type 2 DM as the risk factors and etiologies of Type 2 DM are multi-factorial. Similarly, it is not easy to hypothesize any single unidirectional conduit of yoga action in Type 2 DM. Yoga's mechanisms of action in Type 2 DM are integrated and their effect is multi-systemic. The psycho-neuro-endocrine and immune mechanisms of the action of yoga in Type 2 DM symbolize a possible approach to accepting its holistic effects on disease modulation of Type 2 DM. This review suggests psycho-neuro-endocrine and immune mechanisms that may be imperative to perceptive yoga's actions on Type 2 DM [Figures 2 and 3].

YOGA AND HYPERTENSION

Meditation has been shown to reduce systolic BP and diastolic BP of hypertensive patients in several studies. The mechanism underlying the BP-lowering effect is complicated.^[36-38] One theory suggests that imbalance in autonomic performance plays a key role in the origin of hypertension^[39-41] comparatively over activity of the sympathetic nervous system which ultimately desensitizes cardiopulmonary and arterial baroreceptor reflex and chemoreceptor reflex, leading to a resetting of threshold BP values at which regulatory signals are triggered.^[42] Controlled breathing with prolonged breath cycles may positively alter, i.e., reduces chemoreceptor sensitivity, thereby reducing arterial baroreceptor lethargy and sympathetic outflow.^[43] Other potential mechanisms

Figure 2: Model for obesity, inflammation, and vascular endothelial changes. ER: Endoplasmic reticulum; NF κ B: Nuclear factor kappa beta; IL-6: Interleukin-6; CRP: C-reactive protein; PAI-1: Plasminogen activator inhibitor-1; TNF- α : Tumor necrosis factor-alpha; FFA: Free fatty acids; SMC: Smooth muscle cells; UPR: Unfolded protein response

involve the fact that amplification of tidal volume activates the Hering–Breuer reflex mediated by pulmonary stretch receptors.^[44] This reduces the chemoreflex sensitivity, in turn upregulating baroreflex receptor sensitivity and thereby decreasing arterial BP. It has also been suggested that controlled slow breathing entrains central nervous system nuclei, in which respiratory and cardiovascular system centers cross, thus positively alters the regular sympathetic outflow to the vasculature.^[54] Some other studies suggest that the decrease in BP occurs mainly via a decrease in systemic vascular resistance and total arterial compliance.^[45–47] However, the overall biological mechanism and the integrated neural pathways involved in lowering BP by slow deep breathing have yet to be completely elucidated.

PHYSIOLOGICAL BASIS OF BLOOD PRESSURE LOWERING BY BREATHING EXERCISE

The mechanism whereby meditation techniques lower BP when it occurs remains unclear. It has been suggested that the mechanisms may lead to reductions in stress and physiological arousal, thereby producing favorable effects on the autonomic nervous system balance^[48,49] [Figure 1]. It has been speculated that relaxation techniques may favorably alter autonomic nervous system balance and/or the hypothalamic-pituitary-adrenal (HPA) axis.^[50] The precise pathways responsible when relaxation therapies produce a decrease in BP require clarification.

CONTROLLED BREATHING

Meditation, yoga, and music decrease sympathetic nervous system activity, sensitize arterial and cardiopulmonary baroreceptors, and in so decrease BP lability and increase resting BP. Similarly, slow breathing

Figure 3: Mechanism of action of yoga through parasympathetic activation and associated anti-stress mechanisms. It reduces perceived stress and hypothalamic-pituitary-adrenal axis activation, thereby improving overall metabolic and psychological profiles, increasing insulin sensitivity, and improving glucose tolerance and lipid metabolism. HPA: Hypothalamic-pituitary-adrenal axis; HR: Heart rate; BP: Blood pressure

(<8–10 breath per minute), especially with prolonged expiration, reduced sympathetic nerve activity while increasing parasympathetic activity and reducing BP [Figure 1].^[51,52] The systems require two 12–15 min sessions daily, endeavoring to achieve at least 45 min of slow breathing time per week. While there are no known contraindications, this technique requires a fair amount of discipline. The suitable candidates for this therapy might include the prehypertensive or mildly hypertensives, with small BP reductions required; white coat hypertensives where behavioral feedback may minimize the alerting reaction; as a last resort in patients with resistant hypertension and/or those with multiple medication sensitivities/intolerances; and in patients who seek a greater degree of empowerment in managing their hypertension, but still, more persuasive evidence is needed before device-guided breathing can be more generally recommended for BP reduction.^[53]

ORTHOPEDIC PROBLEMS

Yogasans have been used for orthopedic problems such as cervical spondylosis and backache, which would benefit from strengthening of specific groups of muscles and also from the improvement of posture.^[50] Asans for relaxation have been used for conditions requiring relief from muscle spasm. The favorable effects of yoga in orthopedic problems are not difficult to explain. Asans which strengthen back muscles understandably relieve a backache. Increase in flexibility and decrease in body weight resulting from the asans ameliorate pain not only in the knee joint but also in the other joints.

PHYSIOLOGICAL BASIS OF ACTION OF YOGA IN NONCOMMUNICABLE DISEASES

We know yoga works, but we do not know how it works. The mind–body relationship is now widely accepted and there is considerable evidence supporting it.^[55]

It has shown in one study that a set of selected asans return this sensitivity towards normal. Associated with the return of baroreflex sensitivity is a fall in blood pressure towards normal.^[56] Stress reduction and the favorable effect of positive emotion on the immune response possibly contribute to the beneficial effect effects of yoga in bronchial asthma patients^[55] [Figure 1]. Yogic exercise also benefits asthma by improving pulmonary performance, loss of weight, and physical exercise also improves glucose tolerance, which in turn helps DM. Some dietary modifications add stress reduction, frequently associated with yoga, which may contribute to improvement in glucose tolerance. The same mechanism contributes to the favorable impact on coronary heart disease.^[56] According to the theory proposed by Streeter *et al.*, the decreased parasympathetic nervous system and GABAergic activity that underlie stress-related disorders can be corrected by yoga practices resulting in the amelioration of disease symptoms. Heart rate variability testing has a great role to play in our understanding of intrinsic mechanisms behind such potential effects of yoga. Innes *et al.* had earlier also postulated interconnected pathways by which yoga reduces the risk of CVDs through the mechanisms of parasympathetic activation coupled with decreased reactivity of sympathoadrenal system and HPA axis^[56] [Figure 1].

Therefore a shift in autonomic balance toward parasympathetic dominance may explain the decrease in heart rate, fall in BP, and improvement in gastrointestinal function. The increased glucocorticoid secretion in response to an acute stress may explain the better ability to handle the stress. The physical exercise, dietary modification, and stress reduction associated with yogic practices may explain the fall in plasma glucose and improved lipid profile.

FUTURE PROSPECT AND IMPLICATION OF YOGA

It is now well recognized that stress weakens our immune system. Scientific research in several recent studies has shown that the physiological, psychological, and biochemical impact of yoga are of anti-stress in nature. Mechanisms hypothesized and postulated are the re-establishment of autonomic function balance as well as a progress in healing, regenerative and curative capacity of the individuals.

The main aims of the therapeutic implications of yoga should be to increase parasympathetic and decrease sympathetic activities. It may be further hypothesized that yoga-based practices correct under-activity of the parasympathetic nervous system and gamma-amino butyric acid systems, partly through the stimulation of the vagus nerves, the main peripheral pathway of the parasympathetic nervous system.

This enables us to move from a state of ill health and sickness to the one of fitness and well-being that eventually allows us to move from the lower animal nature to the higher human nature and finally the highest divine nature.

The need of the current time is to have an integrated approach toward complete therapy and to utilize yoga therapy in harmonization, cooperation, and collaboration with other systems of medicine such as modern medicine, Ayurveda, and naturopathy. Advice on diet and lifestyle is very important, irrespective of the mode of therapy that is employed for a particular patient.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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