

EFFECT OF YOGA ON PHYSIOLOGICAL FUNCTIONS AND THERAPEUTIC POTENTIAL OF YOGA

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ABSTRACT

Introduction:

I joined JIPMER in March 1977 as Lecturer in Physiology. Apart from routine teaching, I started research work in right earnest using animals for my study. I soon realized that yoga has great potential not only to improve our physiological functions, but also to prevent and manage stress and a host of chronic diseases that defy modern medicine. Modern medicine (allopathy) is based on linear Newtonian physics. It is disease-oriented (pathy). Allopathic drugs have many undesirable “side effects” and adverse drug reactions (ADR) kill many patients. In contrast, the holistic science of yoga is health-oriented and yogic techniques have desirable “side benefits”. The ancient marvel of yoga has great potential because it is holistic. It is holistic because it improves our physical, mental as well as moral-spiritual health. It is holistic because it has promotive, preventive as well as curative and rehabilitative potential. It is holistic as it helps not only in our horizontal development at physical/physiological plane, but also in-depth mental development and realization of our higher aspirations. It is holistic because it improves our strength, endurance as well as flexibility. Yoga is a holy science based on philosophy that has universal, non-sectarian and timeless appeal. It has the potential to become the enlightened and practical faith of the future “World man” or “Vishvamaanush” conceived by Vedic rishis (*Yasya te vishvamaanusho. Rigved 8: 45: 42*).

The scientific-spiritual discipline of yoga is the most precious gem of our cultural heritage and Vedic thought. Rigved, the first book of humankind exhorts us to meditate on the Divine (*Yunjate man ut yunjate. Rigved 5:81:1*). Yajurved advises yoga for enhancing our physical and mental powers (*Yoge yoge tavastaram vaje vaje havamahe. Yajurved 11:14*). Upanishads are replete with yoga vidya. In unequivocal terms, Yogeshwar Krishna (~3000 BC) emphasizes the superiority of yogi (*Tapasvibhyo adhiko yogi. Bhagavadgita 6:46*). In Bhagavadgita, the term yoga is mentioned 105 times in the 700 verses and other yogic terms like pran, pranayam, samadhi and prajna occur repeatedly. Realizing that yoga has health-promoting and therapeutic potential and it is our cultural heritage, I earnestly took to the research and teaching of yoga in addition to my routine duties as Head of the Department of Physiology. I have given yoga training to many batches of medical and paramedical students, resident doctors, staff of JIPMER, school children, police personnel and patients suffering from various chronic disorders. I am grateful to many of these subjects who participated in my research programmes resulting in publication of many research papers. I have organized 15 national workshops/CMEs/conferences, most of them in yoga. I also guided 45 students for MD,

PhD, MSc and ICMR Studentship, most of the topics being on yoga. My yoga activities got a boost when I established Advanced Centre for Yoga Therapy, Education and Research (ACYTER) at JIPMER on 7 June 08. Information about ACYTER is given at the end of this thesis.

Many studies have demonstrated that yogic techniques produce consistent and beneficial physiological changes and yoga has sound scientific basis. We have demonstrated that yoga training results in a significant increase in respiratory pressures, handgrip strength and endurance and breath holding times (Madanmohan et al. *Indian J Physiol Pharmacol* 1992; 36: 229 – 233). This indicates an improved physical strength and cardio-respiratory endurance. In the same study, we also found a significant decrease in visual and auditory reaction times after yoga training. This indicates a faster information processing by the central nervous system. In another study (Madanmohan et al. *Indian J Physiol Pharmacol* 2004; 48: 461 – 465) we have demonstrated that after yoga training, exercise-induced stress to cardiovascular system is less severe. This means that yoga training improves exercise tolerance and can enable one to tolerate higher exercise loads. We have also demonstrated that 6 week yoga training improves thermoregulatory efficiency as measured by weight loss response to step test (Madanmohan et al. *Indian J Physiol Pharmacol* 2008; 52: 164 – 170). This yoga training-induced attenuation of sweating response to muscular exercise is of physiological significance and indicates improved autonomic regulation and exercise tolerance. Improvement of pulmonary functions and respiratory pressures has also been reported by us (Madanmohan et al. *Indian J Physiol Pharmacol* 2003; 47: 387 – 392).

There are not many studies on the effect of pranayams on physiological functions. In a study comparing the effects of slow and fast pranayams, we have reported that slow pranayams (e.g. savitri pranayam) reduce the basal heart rate (HR) and rate-pressure product (RPP) while training in fast pranayams (e.g. bhastrika) results in an increase in these parameters (Madanmohan et al. *Indian J Physiol Pharmacol* 2005; 49: 313 – 318). Thus, the physiological effects and possibly therapeutic consequences of slow and fast pranayams can be different. From our studies, it is clear that yoga training improves physiological functions and this may explain, at least partly, the health-promoting and therapeutic potential of yoga.

Modern life in full of stress and stress-related disorders are rampant in today's world. Stress is an important factor in etiology as well as progression of chronic diseases including hypertension and coronary artery disease. For prevention as well as management of stress and stress disorders, no method is as effective and far-reaching as yoga. Shavasana as well as dhyana are ideal techniques to calm the mind and make it sharp and one-pointed. They influence our body, mind as well as soul and promote health and healing. Yoga is the panacea for modern stress epidemic and answer to stress disorders. In an interesting work from our laboratories, we have demonstrated that subjects trained in yoga can achieve a state of deep psychosomatic relaxation and significant decrease in

oxygen consumption within 5 minutes of practicing savitri pranayam in shavasan (Madanmohan et al. The Yoga Review 1983; 3: 25 – 34). In another study, we have demonstrated that shavasan improves one's ability to withstand stress as measured by response to cold pressor test and this ability can be achieved by just 7 days of shavasan training (Madanmohan et al. Indian J Physiol Pharmacol 2002; 46: 307 – 312). Slow pranayam breathing during shavasan results in relaxation and mental peace known as samatvam (*Samatvam yoga uchyate. Bhagavadgita, 2: 48*). Regulated, slow, deep and rhythmic breathing is ideal for controlling stress and emotional hang-ups and stabilize our mind. Yoga enables one to withstand stress by normalizing the perception of stress, optimizing reaction to it and effectively releasing pent-up stress through various techniques, including AUM chanting. Slow rhythmic pranayams, dhyana and relaxing asanas are very effective when practiced in combination and performed with awareness.

Yoga has a great therapeutic potential that is as yet untapped. The best way to deal with health problems and illness is to prevent them in the first place. And holistic science of yoga is the best means to achieve this goal since yoga has preventive as well as health-promotive potential in addition to curative potential. In spite of state of the art diagnostic procedures, powerful drugs and major share from the national health budget, modern medicine has not been able to control chronic degenerative diseases whose incidence is rising alarmingly. Hence, there is a pressing need for introducing yoga as an add-on, complementary system to augment modern medicine so that the need for expensive interventional procedures and drugs is significantly reduced.

Therapeutic potential of yoga may be due to its ability to improve physiological functions, modulate autonomic functions, relieve stress and improve general health and quality of life (QoL). In a study on the effects of pranayam on school children (Udupa et al. Indian J Physiol Pharmacol 2003; 47: 27 – 33), we have demonstrated that pranayam training produces a decrease in basal sympathetic tone, an increase in parasympathetic tone and a significant decrease in RPP. RPP is an index of myocardial oxygen consumption and load on the heart. Our finding of decrease in RPP after yoga training indicates that yoga is beneficial to the heart. Hypertension is a common disorder and many patients are on life-long medication. Yoga has great potential to prevent as well as manage hypertension. In a study on patients having essential hypertension, we have demonstrated that yoga training produces a significant decrease in blood pressure (BP) and HR within 3 weeks of the training (Vijayalakshmi et al. Indian J Physiol Pharmacol 2004; 48: 59 – 64). In the same study, we also found that yoga training optimizes the sympathetic response to stressful stimulus like isometric handgrip test. Beneficial effects of pranayam and shavasan in patients having premature ventricular complexes and palpitation has also been demonstrated by us (Prakash et al. International J Cardiol 2006; 111: 450 – 452; Ravindra et al. Ibid 2006; 108: 124 – 125). Recently, we have demonstrated that pranayam breathing at 6 breath / minute can reduce HR and BP of hypertensive patients within 5 minutes of starting the practice (Bhavanani et al. International J Yoga Therapy 2011; 21: 4 – 7).

Our studies demonstrate the health promoting and therapeutic potential of yoga. Yoga can play a significant role in prevention as well as management of hypertension, coronary artery disease and other chronic disorders that comprise more than 60% of health problems. For best results, yogic lifestyle should be adopted early in life since lifestyle changes like coronary atherosclerosis start early in life and we have demonstrated that the levels of low density lipoprotein (LDL) and total cholesterol (TC) are higher in prehypertensive patients (Pavithran et al. Indian J Physiol Pharmacol 2007; 51: 96 – 98).

We have completed a few pilot studies with the aim to plan in-depth studies in near future and to train our yoga staff in research techniques. The results of these unpublished pilot studies are interesting and encouraging. In a study on 15 peri-menopausal patients receiving standard medical treatment for type 2 diabetes mellitus, 6 week comprehensive yoga therapy programme resulted in significant decrease in auditory reaction time, fasting and post-prandial blood glucose, LDL, VLDL and TC. This suggests that a comprehensive yoga therapy programme has the potential to enhance standard medical management of diabetes mellitus and can be used as an effective complementary therapy programme. In another study, 15 patients receiving standard medical treatment for essential hypertension underwent 8 week comprehensive yoga therapy programme. There was an excellent compliance and regularity of yoga practice by the participants. Yoga therapy resulted in improvement of lipid profile, BP and HR. Body weight and body mass index decreased significantly. In conclusion, 8 week comprehensive yoga therapy programme with good compliance has the potential to enhance the beneficial effects of standard medical management of essential hypertension. In a study on 22 patients of essential hypertension who were on standard medical treatment, 27 rounds of chandra nadi pranayam produced an immediate decrease in HR and BP. In another study on 29 hypertensive patients who were on regular medical treatment, we found that 5 min pranav pranayam produced a significant decrease in HR, BP and RPP. Pranav pranayam is simple to perform and can be used in addition to regular drug therapy to improve clinical condition of the patient. India has ~9 crore hypertensive subjects. It will be worthwhile to study if long-term pranayam practice can reduce the drug dosage and thus reduce the financial burden and side effects of drugs.