Neurophysiological Studies of Yoga in Health and Diseases

Dr. T.N. Sathyaprabha
Additional Professor, Neurophysiology & In-Charge,
Autonomic Laboratory, NIMHANS, Bangalore
e-mail: drsathyaprabha@gmail.com

Dr. T.N. Sathyaprabha is an Additional Professor of Neurophysiology at National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore. She has contributed significantly to research in alternative medicine. She has been awarded prestigious “ICMR International Young Scientist fellowship award- 2009”. Other awards to her credit includes Sushila Thakur Prakruthi Mandir award given by APPI, for her work in field of naturapathy and yoga in management of Bronchial asthma, Sir M Visheshwaraya Parsara Rathna award by Kuvempu University. Her research work has been translated in many international publications. She has more than 40 publications. She is also active member of many scientific organizations. She is also reviewer for national and international Journals including Journal of Chinese Clinical Medicine, Clinical and Experimental hypertension etc.

Introduction

Health is not just the mere absence of disease; it’s a positive state where there is a complete harmony of body and mind. The World Health Organization (WHO) defines health as ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’. The present day physical and mental challenges have altered the lifestyle and increased stress, taking their toll on people’s health. In this context, it becomes very imperative to derive benefits from the practice of Yoga that will definitely go a long way in keeping one positively healthy and buoyant.

Yoga refers to a scientific scheme of physical and mental practices that originated in India approximately 3000 yrs ago. The word ‘Yoga’ is derived from Sanskrit root word ‘Yuj’, meaning ‘to control’ or ‘to unite’. The spiritual connotation of this word interprets to the union of the jeevatma (mortal) with the paramatma (immortal). Maharshi Patanjali was the proto-originator of Yoga as a philosophy and his ‘Yoga Darshana’ is the basic treatise of this school of science. Patanjali enunciated ‘Ashtanga Yoga’ i.e. the eight different practices: Yama (abstention), Niyama (observance), Asana (posture), Pranayama (breath regulation), Pratyahara (abstraction), Dharana (concentration), Dhyana (meditation) and Samadhi (liberation). These eight steps are essential for the attainment of a super-conscious state. The purpose of yoga is to achieve our highest potential and lead an enduring life of happiness and health.

Yoga modulates health by influencing almost all systems in our body and improves the quality of life of the practitioners(15). It might be more congruent with values, belief and philosophical orientation towards health and life evincing much interest in recent times. The subjective benefits of yoga such as self-realization, self-awareness are still unaccountable with the available physiological techniques. Even the exact mechanism by which yoga modulates health or disease is not vivid.

Recently however, there have been a lot of advances in understanding the psycho-physio-neurobiology of these yoga techniques. The current article puts together few of the researches on the benefits of yoga in health and disease as assessed by few neurophysiological parameters.
Studies on cardiorespiratory and autonomic variables

Yoga practice is noted to produce changes in heart rate, blood pressure, galvanic skin response, respiratory rate, fasting blood glucose (Type II diabetes mellitus and healthy), breath holding time, auditory and visual reaction times, and intraocular pressure (16). A simple pranayama technique ensures better utilization of oxygen from the air that we breathe, better utilization of lung surface and the better circulation of oxygenated blood (28). Yoga practice has also been shown to influence the cardiovascular system with decrease in heart rate, and blood pressure (21). Practice of yoga inhibits sympathetic tone in the skeletal muscle blood vessels leading to vasodilatation thus decreasing the peripheral vascular resistance and decreasing diastolic BP (19). Studies have shown that there is an increase in the HF power of autonomic functions indicating increased vagal tone and decrease in the LF power which denotes the sympathetic nervous function (22). It has been well documented that practice of yoga induces a shift in the autonomic balance towards relative parasympathetic dominance (8).

Yoga, EEG and evoked potentials

Evoked potentials denote the response to a discrete stimuli and the level of attention of the subject. In an auditory oddball paradigm, there was a reduction in the latency of P300 and increase in the amplitude of P300 in yogic practitioners practicing cyclic meditation (23). The middle latency auditory evoked potentials have also shown a change in the meditators suggesting a prolonged latency in the neural generators in cortical areas(26). This signify a greater cortical inhibition and effective neural modulation at the subcortical level leading to optimal autonomic nervous function.

The EEG reflects the coherent state of the brain during which cognitive and sensory inputs are being processed. The functional relevance or relationship to the state has been stated that in contrast to the spindle activity, the pattern characterized by oscillations in the beta frequency range is typical of brain state of attention information processing (9). The EEG activity in the higher frequency range like beta or gamma wave are associated with behavioral conditions when animal is alert and focusing his attention on a target (5). A similar increase in beta activity is observed in subjects who are practicing Sudarshana Kriya Yoga (SKY) regularly than in healthy controls (3). Anand has confirmed from his extensive studies on practitioners of Transcendal Mediation (TM), an increase in the alpha /delta power and reduction in beta/alpha power (1). Long-term Vihangam Yoga meditation improves attention span, processing speed, attention alternation ability, and performance in interference tests (18).

Yoga and Polysomnography

Sleep architecture and EEG power spectra were studied across sleep stages of kundalini, vipassana and SKY meditators. The beta power was significantly enhanced throughout the sleep stages and delta & theta power were significantly reduced during slow wave (S3-S4) sleep. Sleep architecture demonstrated enhanced quality of sleep, enhanced slow wave sleep (S3, S4) and enhanced Rapid Eye Movement (REM) sleep. REM sleep is associated with memory consolidation. REM sleep may be a privileged period for brain plasticity (enhances the activity of neuronal circuits which are usually dormant during wakefulness). Hence a possible beneficial role of yoga in sleep-wakefulness behavior may be postulated (27).
Yoga and disease

Yoga philosophy attributes most diseases to insufficient life force, either in the body as a whole, or a blockage of life force localized to one part of the body leading to decrease in immunity and increased susceptibility to infections. Yoga emphasizes treatment of the root cause and not the symptoms. Yogic philosophy and practices have been used for treatment as well as an adjuvant to available therapies in different disease states.

Yoga in neurological disorders

Studies have shown that yoga as an adjuvant therapy can improve the cardiac autonomic parameters in refractory epilepsy patients; the imbalance in autonomic parameters being considered as a reason for the SUDEP (Sudden Unexpected Death in Epilepsy) phenomenon in epilepsy (24). Sahaja yoga practice has been shown to reduce the seizure frequency by 62% at 3 months and a further decrease of 86% at 6 months of intervention (17). The effect was not limited to the seizure frequency reduction and EEG changes, but also in the quality of life of these subjects (31). Epilepsy is a complex phenomenon with many paradoxical aspects. Increasing brain desynchronization seems to be the key at breaking the forced oscillations of a seizure. Yoga achieves this through increase in sensory-motor rhythm, decreasing stress and possibly influencing brain plasticity. Yoga also reduces stress, increases central inhibitory GABA levels and alters CNS blood flow and leads to an autonomic quieting thus addressing both the seizures and its associated autonomic dysfunction. Yoga has also been recommended as one of the additional method of treatment in the holistic management of chronic intractable epilepsy (12).

Yoga therapy with yogic postures, pranayama, relaxation techniques and meditation techniques showed significant reduction in headache frequency and associated clinical features in migraine patients over a period of 3 months (11). The American College of Physicians and American Pain Society recently recommended the addition of yoga or progressive relaxation for patients with acute low back pain who do not improve with self-care options (30). The effects of these interventions in multiple sclerosis are vague demanding more longitudinal studies (7). In post stroke rehabilitation too, yoga intervention was found to improve the balance and mobility, but the small sample sizes and lack of further studies hinder a clear cut view on the effect of yoga in stroke (13).

Yoga in psychiatric illnesses

Mental health refers to the social, spiritual, physical and emotional aspects of a person’s life. The philosophy of the Yoga ascertains a conditioned mind that establishes the most profound experience of joy and inner freedom. Yoga interventions have been tried in the management of many psychiatric disorders. Meditation techniques have been used as a method for reducing stress and anxiety for several years. Studies have shown clearly that practice of yoga for approximately 2 months definitely reduces the stress and improves the psychological well being in subjects with mental stress (10, 14). Different schools of yoga practice like vinyasa yoga, hatha yoga etc has been shown as effective interventions in treating depression and anxiety states (29). These subjects exhibited significant decrease in depression symptoms and increase in mindfulness and behavior activation. Yogic practice might act via different biological, psychological or behavioral mechanisms in modulating changes in depressive subjects. Yoga has been shown to have a better symptomatic relief and reduction in psychopathology when compared to subjects treated with antipsychotic drug therapy alone in schizophrenia patients (6). Four month yoga practice improved the facial recognition
and socio-occupational performance in schizophrenia (2). It also offered benefits as an effective tool to increase imitation, cognitive skills and social-communicative behaviors in children with autism spectrum disorders. In addition, children exhibited increased skills in eye contact, sitting tolerance, non-verbal communication and receptive skills to verbal commands related to spatial relationship (20). Yoga practice has been shown to increase the brain GABA levels, so might act better in pathologies were low GABA level is postulated as the cause like anxiety and depression (25). Yoga and relaxation therapies have also been tried along with conventional methods in smoking cessation and have shown reduction in the withdrawal symptoms and craving, but more experimental data is lacking (4).

Conclusion

The importance of Complimentary and Alternate medicine (CAM) in health and disease has received much attention in the recent times and Yoga occupies a significant position in the CAM. Yoga can efficiently aid to maintain the milieu interior of the body. The practice of yoga leads to a state of positive health, attitude and enhanced immunity. There is also better oxygen utility, lesser state of autonomic arousal, with shift of sympathovagal balance towards a vagal predominance, increased attention and better sleep. It also reduces anxiety and stress and enhances our mood resulting in a sense of inner peace and purpose, which has far-reaching health benefits. Many uncertainties and methodological problems, both theoretical as well as practical issues, surround research pertaining to yoga in health and disease. The effect of this technique needs to be further explored and more scientific studies should come focusing on the physiological mechanisms behind yoga practice.

Reference List:


21. Ravinder Jerath *JWEVABVJ. Physiology of long pranayamic breathing: Neural respiratory elements may provide a mechanism that explains how slow deep breathing shifts the autonomic nervous system. *Medical Hypothesis* 2006.


