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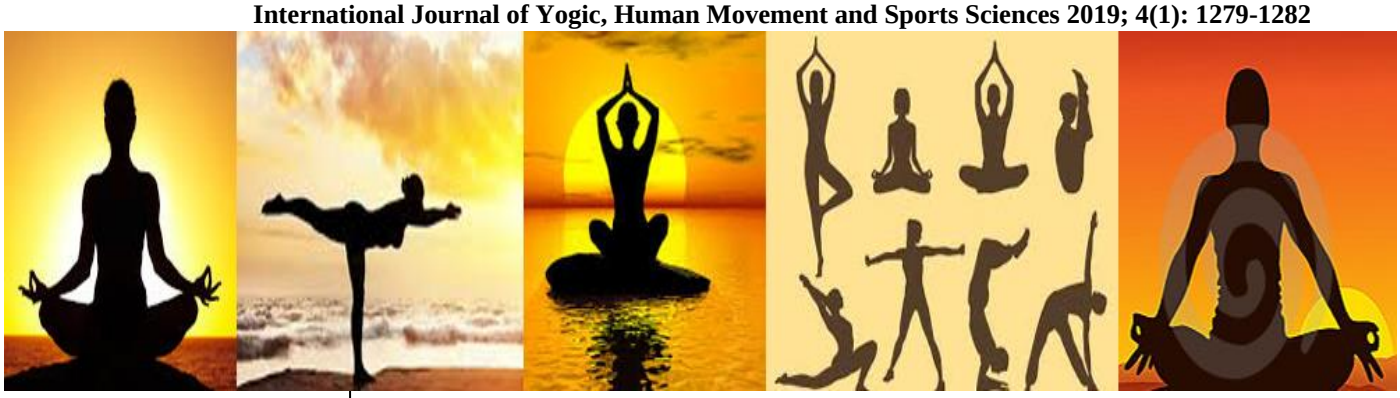

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Tripathi Piyush Kumar
Department of Kriya Sharir,
R.K. Ayurvedic Medical College & Hospital, Kashipur, Surai, Sathiaon, Azamgarh,
Uttar Pradesh, India

Correspondence
Tripathi Piyush Kumar
Department of Kriya Sharir,
R.K. Ayurvedic Medical College & Hospital, Kashipur, Surai, Sathiaon, Azamgarh,
Uttar Pradesh, India

Exploring the effect of yoga on body and mind physiology

Tripathi Piyush Kumar

Abstract
Yoga is both an art and science of living being. Modern era is full of challenges and stresses and in way to outcome these humans land up in situation of so many physiological and psychological disturbances. This physiological and psychological illness leads humans into vicious circle of physical and mental imbalance and personality disorder. While modern medicine has the ability in many cases to heal physical diseases and alleviate psychological disorders, it is argued that a purely medical approach is far less effective in healing emotional, spiritual, and intellectual layers of human being. Yoga a science from ancient Indian wisdom has miraculous effect on almost every physiological system and mind as well of human being. It has shown a very promising effect in curing ailments related to these that needs to be explored.

Keywords: Yoga, body and mind physiology

1. Introduction
In Indian religion, yoga (from *Sanskri*t word) has been used as means or technique for transforming consciousness and attaining liberation or salvation (moksha) from Karma and rebirth(samsara).Term Yoga is derived from term "*Yujir yoge*" means to unite. Ultimate goal of yoga is considered as union of *Atma* with God. Yoga is the method that creates harmony by aligning mind, body and soul into equilibrium state. It is the mind and body practice which support life in a positive way. It is an ancient Indian science and philosophy both for mental, physical, social and spiritual health and aiming to fulfill the potential of man. Yoga affect the body and mind by changing the internal environment which control nervous system ultimately affecting sympathetic, parasympathetic system, release of neurotransmitters, hormonal outflow, mind and brain functioning, thought process i.e. affect the whole homeostasis of body. So it has very diverse effect on the body and mind physiology. Its definitive role in elimination and prevention of a lot of diseases has been approved. It also helps to prevent and cure degenerative and psychosomatic diseases. It is a well known fact that 21st century is going to be era of stress, mental tension and other psychic disorders. Yoga has a very definitive role in this.
During last two decades yoga has attained significance worldwide and not remained only a science of spirituality but a science of biological significance as well. Owing to its miraculous effect United nations has declared 21st June as international yoga day. So now a day yoga is accepted and practiced for fitness in terms of prevention and cure of diseases worldwide and maintenance of health as well.

2. Historical Background
Yoga one of the oldest science finds its root paved in Indian civilization. It has been practiced since its origin not only to achieve physical, mental and spiritual health but it has remained a very strong and successful measure to achieve fourth pursuit of life i.e. *Moksha* (salvation) according to hindu religion. Mythologically Lord Shiva is considered as the first teacher of Yoga. His one famous idol Natraja depicts assimilation of so many of yoga mudra. Yogic methodology can be found in all branches of Indian spiritual and religious literature, whether Vedas, Epics, Agamas, Puranas and Tantras and in so many treatises related to Yoga. Various types of asanas, pranayaam, mudras etc are fully described in Vedas. Pancha kosha theory

explained in Taittiriya Upanishad [1] is used in treatment of so many diseases. Kathopanishad [1] describes method to achieve Samadhi. Linga Purana gives the full description of Ashtanga Yoga. Acharya Patanjali ancestor of present era Yoga described 196 yoga sutras in four padas (sections) i.e. Samadhi Pada, Sadhana Pada, Vibhuti Pada and Kaivalya Pada. Shankaracharya wrote Yoga Tatvavali and Soundarya Lahari where hath yoga and kundalini yoga are described. Ramanujacharya [1] wrote Tantrasara on Kundalini Yoga. Followers of Nath sampradaya popularized Hatha Yoga. So wisdom of yoga finds its dimensions in all Indian wisdom.

3. Mechanism of Action of Yoga

Although mode of action through which Yogic practices affect the body mind homeostasis, health promotion, elimination of disease etc is not clearly understood but certain researches have provided definitive clue regarding mode of action. Many researchers have found that regular practice of deep meditation, deep breathing practices, yogic exercises, asanas have definitive changes at brain and its neurochemical functioning. Researchers [2] have found that level of brain derived nurotrophic factor (BDNF), circadian salivary cortisol levels, pro-anti inflammatory cytokines level and cortisol awaking response (CAR) has been increased by these practices. Increased level of BDNF and CAR is associated with increased nuroplasticity and level of alertness respectively that in turn has good hippocampal integrity activity maintaining hypothalamic pitutary adrenal (HPA) axis equilibrium. Other researches [3] postulates that effect of Yoga is combined effect of increased parasympathetic activity, decreased sympathetic activity, increased GABA activity (a neurotransmitter in brain) and increased anti-inflammatory markers in body. Some other studies suggest that long term yogic exercises have definitive control over gene expression [4].

4. Role of Yoga on Body, Mind Physiology and Improving Quality of Life

Yoga is having a traditional method of having peace and calm via having its potential effect on body and mind physiology. It increases the flexibility of body parts and improves body's physical condition by enhancing the activity of circulatory system and helps in cleaning body channels which facilitates the entry and exit of metabolic waste products. Yoga has a very definitive role on almost every system of body e.g. cardiovascular system, respiratory system, musculoskeletal system, endocrine system and mind physiology. So it can be used in a holistic approach to maintain body health.

5. Effect of Yoga Practice on different body system Physiology

5.1 Nervous System Physiology

One of the most important system that is ultimately affected by yoga in a positive manner is nervous system that in turn controls the whole body. Practice of deep relaxation techniques for a longer duration has shown a profound effect on the autonomic nervous system functions. It reduces sympathetic activity [5] and increases parasympathetic activity via activating medulla in brain stem ultimately reducing [6, 7] the catabolic functions in body. So body reduces its oxygen consumption and entropy is also reduced. In long term via activating vagus activity [8, 9] it reduces heart rate, respiratory rate, energy consumption and promotes mental calmness, alertness, attention, motor response, improves motor response [10] and higher coordinated movements [11]. It causes changes in hypothalamic pituitary cotical axis.

5.2 Respiratory System Physiology

This is the main system in the body through which main yogic exercises are practiced i.e. deep yogic breathing etc. so this is one of the most important system that primarily affected in due course of time. Regular practice of controlled breathing has resulted in increased tidal volume, inspiratory reserve volume and vital capacity, breath holding [12] time after expiration, breath holding time after inspiration, increases in the forced vital capacity, forced expiratory volume at the end of first second, maximum voluntary ventilation, peak expiratory flow rate, and prolongation of breath holding time i.e almost all important respiratory parameters are improved [13]. Deep inflatory exercises like Pranayaam, bhastrika, kapalbhati etc. causes consistent adaptation in stretch receptors present in lungs tissue ultimately altering hering breuer reflex response that in turn is master pathway to alter lung function and capacity. Alteration in this reflex causes increased threshold for pneumotaxic center in brain stem that ultimately gives an edge to parasympathetic function over sympathetic one via reducing respiratory rate, increasing depth of inspiration and better respiratory control [14, 15, 16]. Yoga has definitive role in chronic obstructive pulmonary diseases [17] like asthama. Asthamatic [18] patients have shown improvement in respiratory parameters via practicing yogic exercises.

5.3 Cardiovascular system Physiology

Yoga has a definitive role on cardiovascular [19] system. Consistent yogic exercises like shavasan [20] reduces oxygen consumption significantly. Pranayama breathing reduces heart rate and blood pressure in long term. Since activity of parasympathetic system increases and sympathetic system decreases so vagal activity is dominated due to positive feedback from Nucleus Tractus Solitarious (NTS) [21]. Increased vagal activity reduces sympathetic overdrive, increases release of acetylcholine over Sino-atrial node and Atrio- ventricular node that diminishes heart rate. Reduction in sympathetic release causes reduced concentration of noradrenaline in blood so force of myocardial contraction is reduced. Both of these phenomenon results in reduced cardiac output and finally reduces blood pressure [22]. Evidences show that Yogic practices has helped in regression of coronary plaques, improving myocardial perfusion and symptomatic improvement in angiographically proved coronary artery disease patients.

5.4 Musculoskeletal system Physiology

Yoga is now extensively used regularly in sports physiology and in other sectors where muscle fitness, coordination, strength, focus, coordination is required. Yoga creates uniform muscle balance around each joint. It enables eccentric contractions to muscles to a greater length enabling a greater practical flexibility via energetically linking the areas crossing the joint to increase strength and flexibility. Enhanced joint and muscle pliancy translates to a greater range of motion, or an increase in the performance latitude for a particular movement or series of movement [23]. It brings increased steadiness, strength, stamina, flexibility, endurance, anaerobic power, better neuro-muscular coordination and improved orthostatic tolerance in muscles ultimately improving individuals overall muscular performance. It increases physical fitness [24] in individuals by building strength and improving the muscle mass. It causes better balance and coordination means enhanced control over group of muscles.

5.5 Effect on Endocrine System Physiology

Regular yogic practices have a positive response in endocrine disorders. Since it has definitive effect on endocrine organs through hypothalamic pituitary axis; it profoundly affects functions of endocrine glands. In case of diabetic patients it has been found that yoga not only increases insulin receptor sensitivity [25] but also decreases peripheral resistance also. It has also been found that it increases response of beta cells (producing insulin) to increased level of glucose [26]. It is suggested that deep meditation practices influence the leptin secretion in body and control the waist hip circumference level as well.

5.6 Effect of Yoga on Mind Physiology

This is one of the most extensively explored sector showing most profound effect. Deep meditation practices intervenes body physiology through alteration in mind physiology itself. Now a days yoga is extensively used to fight stress and anxiety [27] that has emerged as one of the culminating threat to mental piece and health. Stress and other psychic disorders involve hyperactivity of limbic and autonomic system. Stress is a general term to various mental and bodily pressures experienced by people. It can alter health, emotion as well as it can affect cognitive functions, impairs concentration, attention, decision making ability and creativity. Asanas specially Shavasana, Dhanurasan, Uttanasan and Marjaryasana are very good one for stress management. Ashtanga Yoga and Adhomukha Swanasana are other yogic practices that have shown promising results. Consistent yoga practice improves depression and can lead to increase in level of serotonin levels coupled with decrease in levels of monoamine oxidase that improves feeling of well being and acts as mood elevator [28]. Yoga leads to an inhibition of posterior area of hypothalamus that in turn inhibit areas responsible for fear, aggressiveness, rage, anger, apprehension and stimulates rewarding pleasure centers in median forebrain and other areas leading to state of bliss and pleasure.

6. Conclusion

Yoga includes the practice to maintain the physical health to develop mental clarity and to achieve emotional harmony. As personality wise every individual is unique in nature, one can adopt yoga according to its own configuration as practices of yoga are multi faceted in nature. Almost all the systems of body are stimulated, energized and become more efficient for performing their assigned task. Yoga has a direct bearing on endocrine functions, nervous balance, emotional set ups, and all important physiological aspects of body. It is universally acceptable, easily accessible, cost effective method that can be used to eliminate the disorders and helps in maintenance of health as well. It should be explored to serve the mankind.

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