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Wellness - Homeostasis through Yoga

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Abstract

Adoption of yogic practice beneficially modulates homeostasis from the holistic organismic as well as reductionist cellular approach. It subtly affects not only the physical body but also other kosh or sheaths, thus imparting psychophysiological well-being and spiritual growth. Every physiological system has been shown to be nurtured with optimal conditions for its functioning near set-point, thus conserving the fine-tuning at large. Often an analogy may be drawn between the medical science of today and the Vedantic science of ancient times, thus asserting that even minor attempts to imbibe yogasanas in routine life would benefit the practitioner. Not everything can be tested or measured, as the so-called-imperceptible things are beyond our ability to sense or comprehend. Though physiological and anatomical changes may be monitored, the achievement of mental tranquility may also be the marker for yoga as the alternative medicine.

Keywords: Yoga; Psychophysiological well-being; Alternative medicine

Abbreviations: PET: Positron Emission Tomography; MRI: Magnetic Resonance Imaging; FMRI: Functional MRI; EEG: Electroencephalography

Introduction

Yogic practice is a form of lifestyle encompassing bridled thoughts, words and actions for realization of the Brahman or Self within individual human beings. The sincere seeker requires to lead a spiritual life which will endow him/her with bliss which again shall psychosomatically enhance his/her physiological well-being. This is furthered by intake of fresh food as 'prasadam' which retains all nourishment, thus enhancing the 'prana' or life-force of the consumer yogi. This body comprises of Annamay kosh which is gross and thus can be dealt with by materialistic science. The effect of asanas, pranayama, dhyan can be monitored only at this level as it is devoid of instruments or yardsticks beyond this kosh. Psychosomatic expression includes all the koshas together Annamay, Pranmay, Manomay and Vijnaymay kosh and we in sthula sharira are thus affected by distortions in subtle or causal body. Allopathic medicines act on this kosh (gross body) superficially treating the disease but it cannot access the root cause of the deviated homeostasis settled in other kosh. Alternative modalities of treatment viz., homeopathy, music-colour-aromatherapy or placebo probably partially affect the subtle body or Manomay kosh. Practice of the eight limbs of yoga positively modulates the five pranas which in turn renders a strong body, mind, memory, intellect and beneficially directed ego, which effectively control the brain (sahasrar) and nervous system. This ultimately distributes bliss to all organs thus maximizing homeostasis.

Methodology

The article has been compiled primarily from references from original scientific research articles, review materials from internet sites viz., Pubmed, ScopeMed, ResearchGate, Cochrane Library, related to physiological interpretation of yogasanas. These have been correlated with philosophy of Vedantic sutras with tangible extension into the spiritual realm.

Review

Scientific evidence proves beyond doubt that yoga has the potential to promote homeostasis, preventing and curing stress. Heyam Sukham Anagatam implies that the 'purpose of yoga is to stop the misery before it arises'. Yoga is an experiential science for medical professionals, healthy beings and patients. It is highly recommended as a lifestyle adjunct in non-pharmacological alternate therapy, to reduce drug dosage and enhance quality of life. It is most effective in prevention and management of stress, chronic degeneration, old age and lifestyle related disorders. Stress adversely affects immune functions and neuroendocrine axis, leading to pathophysiological state. Reactive oxygen

species or toxic metabolites of oxygen are implicated in aging and in the etiology of cardiovascular disease, diabetes, cancer, neurodegenerative disorders, etc. [1] Yogic practice plays a pivotal role in revival from trauma, stroke and infections [2,3]. It favourably modulates the nervous system by promoting relaxation in cohesion with attention and cognition. Meditation entrains purity of heart, clarity of thought and spontaneity in action. This leads to satisfaction and less repentance which in turn increases concentration. The objective and subjective quality of sleep is also thus enhanced [4] Practice of yoga reduces performance anxiety, mood disturbance [5] and depression [6] compared to patients only on anti-depressants [7]. It boosts self-confidence, improves interpersonal relationship, increases attentiveness, lowers irritability levels ultimately endowing efficiency and optimism [8]. There is better adjustment to the environmental and internal stressors so that these practitioners with calm disposition show improved performance. Dhyan and shavasan improve attentiveness [9,10] with reduction in visual and auditory reaction times [11] indicating improved visual scanning abilities by ignoring extraneous stimuli through refined processing of the central nervous system [12] Other cognitive functions also improve, viz, eye-hand co-ordination, speed, accuracy, reversal ability [13,14] and increase in critical flicker fusion frequency, i.e., persistence of vision [15].

In yogic practitioners, the modulation in brain blood flow and metabolism are in favour of optimization of sensory-motor abilities along with induction of tranquility through alteration in higher-order cognitive functions, brain structures and activity. Spatial functioning of brain may be detected by its higher glucose metabolism whereas long-term enhancement of brain functioning capacity may be determined by its increase in grey matter. Such spatial cerebral metabolic response to glucose metabolism alter in response to external or mental stimulation as observed from positron emission tomography (PET) analysis, [16] especially after yoganidra meditation [17]. PET scans analyze body functions whereas Magnetic Resonance Imaging (MRI) shows body structures. MRI brain images show that meditators have more concentration of gray matter in the right anterior insula, which is involved in interoceptive awareness arising from the body [18] in the left inferior temporal gyrus and right hippocampus, which are deeply involved in meditation; in the right orbito-frontal cortex, right thalamus, left inferior temporal gyrus, right hippocampus [19] all of which are involved in habits that inculcate positive stable emotions and mindful behavior. The temporal processing of brain stimuli through Functional MRI (fMRI) helps detect brain areas with high metabolic activity by measuring minute increase in blood flow. Heightened activity has been observed in the anterior cingulate cortex, frontal, prefrontal cortex and dorso-medial prefrontal area during Zen, Vipassana and transcendental meditation [18]. Such overactivity has also been observed in the cingulate cortex amygdala, temporo-parietal junction and right posterior superior temporal sulcus circuitry in meditators practising “compassion meditation” or emotional sounds. This also indicates that they are more sensitive to positive emotional expression [20]. The frontopolar cortex or Brodmann area 10 is primarily related to meta-awareness; whereas the sensory and insular cortex are concerned with body awareness; the hippocampus with memory reconsolidation anterior cingulate and orbitofrontal cortex with emotional regulation which all ultimately improve self-regulation and attentiveness leading to association and execution. These brain structures of the meditators show changes in the grey and white matter [21]. Despite increasing age of the long-term meditators, substantial retention of grey matter is observed in the putamen, which show slower decline in their learning ability, attentiveness and cognitive flexibility [22] They are also more tolerant to pain, [23] psychophysiologically, as evident from the changes in their somatosensory cortices [24]. Regular practice of yoga and meditation favorably alter the levels of various brain neurotransmitters that link neurons thus helping form the networks. Gamma amino butyric acid or GABA, a neurotransmitter used as antidepressant, is released after a single session of yoga proving its role in amelioration of depression and related anxiety disorders [25]. PET scan shows 65% increase in endogenous dopamine (feel good factor) release during yognidra meditation and decreased blood flow in prefrontal, cerebellar and subcortical regions, which subserve executive control over cognitive processes [26]. Monitoring of brain waves that are akin to those in deep sleep closely mimic a meditative state, where the subject is free from any form of stress. Neuroscience and psychology have analyzed brain trait and state alterations in meditators through electroencephalography (EEG). Analyses from such recordings of brain neuron frequencies give a temporal insight into the neuronal dynamics depicting the state of the mind, which is modified by the practice of meditation. Such practitioners show temporally distinct EEG recording pattern through delta, theta and alpha frequency bands differentially characterizing various phases of meditation, apart from sleep. Less activation in the amygdala of brain denotes achievement of a steady focus, after attaining the state of focused attention. Parasympathetic activity reduced hippocampal density of gray matter and monoamine secretion are contributory to stress-mediated depression. With practice of meditation, these levels are altered thus enhancing the ability to handle emotional fluctuations, cognition, hormonal and autonomic controls. A long-term meditator with sharp awareness may be distinguished from his/her sleep by lower frequency of alpha waves and theta waves, [27] decreased alpha blocking and increased frontal lobe-specific theta activity [28-30]. So, the coherence and percentage of alpha waves are quantitatively higher in meditators [31] especially Sahaj Yoga practitioners, [32] along with enhancement of cognitive processing [33].

The autonomic nervous system plays the most vital role in inducing relaxation. It consists of the sympathetic and the parasympathetic nervous system. The ida and pingla nadis are probably superimposed on the sympathetic and parasympathetic

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nervous system, whereas the susumna nadi possibly corresponds to the spinal cord area, all probably in different kosh. Yoga balances the two by inducing a state of parasympathetic dominance and restoring autonomic regulatory reflex mechanisms [34,35] The uninostril breathing or anulom vilom pranayama optimizes autonomic functions [36,37] balancing the activity of the left and right brains [38]. There is deep psychophysiological relaxation, improved somatic steadiness [39] relaxation in peripheral autonomic tone, sweating and cutaneous circulation [40] all characteristics of pranayama practice. Alternate nostril breathing induces fewer errors. Left nostril breathing improves spatial cognitive tasks whereas, right nostril breathing enhances verbal tasks [41]. Yogasanas affect the vascular system. The arteriovenous vascular system is responsible for channelizing nutrients and energy to the body, which may vaguely be akin to the invisible 72,000 nadis or channels. The source and extension of the prana channels probably extend beyond the gross body to the subtle and causal forms which might explain the unidentified power behind meagre intake of food, sparse sleep, yet indomitable energy in the yogis (spiritual practitioners). Regularity in yogasana practice improves cardio-respiratory efficiency as evident from lowered sweating response, increased respiratory pressures, endurance, maximum inspiratory / expiratory pressure, improved ventilatory function viz., prolongation of breath holding time, etc. [42,43] and hand grip strength [44,45]. Even brief intervention by yogic techniques considerably boosts overall performance and work capacity, contributing to better management of lifestyle diseases [46] compared to walking or exercise [47]. Yogic practice optimizes heart rate, blood pressure and oxygen consumption [48]. This is achieved by decrease in the frequency and intensity of internal and environmental signals reaching the hypothalamus, resulting in deep psychosomatic relaxation [49,50] Yogasana improves exercise tolerance by increasing cardiovascular endurance, anaerobic threshold and thus the cardiac recovery index [51,52] It delays onset of fatigue and enables one to perform work at reduced maximal oxygen ventilation [53] The increased heart rate returns to normal pre-stress level earlier in meditators than in relaxed subjects [54]. Cardiac disease risk factors are modified through yoga with decrease in unhealthy serum lipid markers [55] Baroreflex sensitivity (involved in cardiovascular regulation) [56,57] renin-angiotensin and sympatho-adrenal activity (involved in blood pressure automation) are reduced favourably through yogic practice in essential hypertensives [58]. Besides reduction of the age-induced deterioration in cardiovascular functions, the coronary lesions and myocardial perfusion which are determinants of quality of the heart, improve with yogic lifestyle [59-61]. Yogic techniques involving isometric contraction increase skeletal muscle strength. These isometric exercise postures assumed during yoga practice improve dexterity, strength and neuro-musculo-skeletal coordination, improve orthostatic tolerance and gait with upright posture and balance, strengthen bones and prevent age-related weakening. During yoga practice, stimuli to respiratory centers are consciously changed, thus controlling respiration, which is said to exert an effective control over the mind and its flow of thoughts. Practice of pranayama has been observed to lower exertion-induced supranormal level of blood lactate which cause exhaustion and pain in the athletes [53,62]. Yogic practice also boosts immunity. Asana postures that open the chest and throat stimulate the thymus gland which induce production of progenitor cells to combat infection. Head-down poses improve circulation of lymph and immune cells to all parts of the body twisting and opening poses activate the spleen which acts as a filter for the damaged cells. In general, asanas improve nutrient, gas, drug circulation and expulsion of excretory products from skin, lungs, liver, kidney and large intestine. It also rejuvenates internal organs and activates energy pathways for efficient healing. Stress induces inflammatory markers and boosts procytokines which compromise immunity, whereas yogic practice reverses this trend to release only immune-enhancing factors [63]. Practice of Sudarshan kriya pranayama by cancer patients has been shown to activate their innate immune system through increased production of natural killer cells [64]. There is also overall decline in perceived stress and trait anxiety or obstetric complications in yogasana practicing pregnant women. Doctors presently recommend prenatal yoga to pregnant women to help them combat pregnancy stress, ease parturition, reduce pain from baseline to post intervention and increase birth weight with least complications [65,66]. Yoga thus orchestrates fine tuning of aggregate homeostasis. It uniquely balances the neuro-endocrine axis, superseding the brain. Reduction in stress hormones, viz., serum cortisol levels [67] reduced or absence of urinary excretion of dopamine, aldosterone, adrenaline, noradrenaline, serum testosterone, luteinizing hormone [68-70] synergistically denote the endocrine efficiency through yogasansas. Plasma melatonin level, which chronobiologically rises with darkness thus inducing sleep, have been observed to increase in experienced meditators after meditation than on a corresponding night [71].

Conclusion

Yoga is thus the auto reset button of the body within healthy limits. It accelerates the reboot mechanism by a holistic approach, similar to Ayurveda and Homeopathy. Its practice affects every human organ and cell for better neuro-effector communication. The asanas improve musculoskeletal strength, optimizing homeostasis, enhancing resistance power, and relieving stress. It primarily endows the practitioner with tranquility, equanimity, and positive attitude for a purposeful healthier life. Medical research perceives the 'glimpse of the infinity' as an imperceptible phenomenon as it is beyond the scope of its measurement or assessment. Further, the inability to obtain proper control samples for the complete yogic practice, makes it difficult to decipher the changes. Ideally, the EEG, fMRI, etc. should be assessed before a person adopts this 8-fold path of life which will lead him/her to dharana, pratyahara, dhyan and ultimately to Samadhi.

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Unfortunately, that intermittent assessments have not yet been possible with a statistically significant group. Impact of Yogic practice is not within the purview of technology except partially for the asanas and meditation. Ideally, experimental subjects are to be measured under severely stringent conditions which cannot ever be subserved on any group of dedicated practitioners who passionately melt into these processes encompassing all the eight-fold path in accordance with Patanjali's yogasutras. Similarly, the previous data of good practitioners cannot be obtained. Here it is worth reiterating that uncaptured by the realms of technology, does not assert or imply nonexistence of the Vedic statements, as only invisible tools can assess the invisible. Though "Jat pinde tat brahmande," had been inscribed in the scriptures thousands of years ago, in a technology-bereft world, it is well interpretable today, by the understanding that the body is made up of only the five elements of the environment. It may also be said that the alignment and movement of all molecular subatomic particles are in coherence with that of the Solar system in the Milky Way of our universe. It is also to be remembered that communication in the animal-fish-bird-insect and plant world, is mediated by light of imperceptible rays (ultraviolet, infra-red), human incognizant incomprehensible sounds (ultra-audible and infra-audible), with a range of perceptibility which is quite beyond our arena of capability. So ungraspable by the human mind does not necessitate obliteration of facts. If this age-old verdict could be translated into truth today, then the benefits of yoga should not remain an apprehension but should be strongly believed as the yet unprovable path to the relief of mundane physical and mental misery, by merely asserting on the 'feel-good factor' of the practising individuals.

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