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Congnitive functions and stability improval through correcting cicardian rythm with yoga in elderly individuals

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Abstract

Sleep is a complex physiologic state. Sleep plays an important role in consolidation of different types of memory and contributes to insightful, inferential thinking. In old age due to decreased circadian rhythm sleep pattern changes it affects overall health of the elderly. Acute sleep deprivation and chronic sleep restriction both practices lead to neuro degeneration. Circadian rhythms affect multiple aspects of cognitive functions, particularly those needed for effort-intensive cognitive tasks. These include inhibitory control, working memory, task switching, and psychomotor vigilance. Yoga is an ancient Indian lifestyle which provides structured guidelines for healthy living. Yogic lifestyle seems like an essential manual to balance human circadian rhythm. The review it has been suggested that yogic lifestyle effects circadian rhythm in the positive manner. Sleep wake cycle is majorly fixed by the yogic lifestyle followed by behavioural modification and appetite.

Key words

Sleep deprivation, yogic practices, circadian rhythm, cognition

Introduction

The role of sleep is vital in maintaining a healthy aging brain. Brain health is affected in older individuals due to age related changes in sleep patterns due to decreased circadian rhythmicity[i] and corresponding reduction leads to impaired alertness and performance in older subjects. Self reported sleep problems seem to reflect poor overall quality of sleep, which in turn has been associated with changes in cognition[ii]. Sleep dysregulation could be early symptom of neuro-degeneration leading to cognitive decline. Age related changes in SCN play important role in age related behavioural changes. Previous studies has shown the electrophysiological activity of aged SCN neurons in vitro is altered (Satinoff et al., 1993; Watanabe et al.,1995; Aujard et al.,2001; Biello,2009). Increased risk of fall with increasing age suggest a possible cicardian rhythym of postural control. In *Ayurveda Nidra* is one among the supporting pillars of life (*Traya-upastambha*). The sleeping urge is one among non-suppressible natural urges. [Cha. Sa. Sutra Sthana 7/3]. Properly observed sleep can provide happiness, nourishment to *Mansika Bhava*, strength (*Ojas*). [Cha.Sa.

Sutra Sthana 21/36-38] i.e. can be correlated to release of neurotransmitters like serotinine, dopamine the happiness hormones. *Kapha Dosha* and inertia (*Tamas guna*) state leads to sleep (*Nidra*). [Cha. Sa. Sutra Sthana 21/35], [Su. Sa. Sharira Sthana 4/34].

The interplay of two significant processes regulates the sleep-wake system (Circadian rhythm)[iii]

A) Process S is homeostatic drive for sleep. It is regulated by the neurons found in preoptic area of the hypothalamus of the brain. These neurons contains molecules that inhibit neuronal communication and turn off the arousal systems during sleep. [iv]

B) Process C promotes wakefulness and alertness. The circadian system regulates it. Wakefulness is generated by an ascending arousal system from the brainstem. This activates forebrain structures by transmitting sensory information to the cerebral cortex and activating the nerve cells to interpret and analyze the sensory inputs.[v]

Process S is similar to the functions of *Kapha Dosha* and *Tamas guna* that promotes sleep. Process C is similar to functions of *Vata dosha* and *Rajo Guna* that promoted wakefulness. We can correlate aggravation of *Vata dosha* leads to *Nidra nasha* (loss of sleep) [A. Hr. Sutra sthana 11/6].

In general TST (total sleep time) decreases with age, loss in the quality of *Ratri swabhav prabhava nidra*, the proportion of NREM (non-rapid eye movement sleep) stage 1 and stage 2 increases with age (indicator of increased *Rajo guna*) and the proportion of slow-wave sleep and REM sleep decreases with age.[vi] Thus sleep disorders/ disrupted circadian rhythm can develop pain conditions, neurodegenerative disease[vii] (postural instability), cognitive decline, RLS (restless legs syndrome), PLMD (periodic limb movement disorders) and impaired immune functioning.

This review article is aimed to investigate possible effects of yogic practice on improvement of cognitive function and postural stability through circadian rhythm regulation in the elderly.

Methods

In *Astanga Ayurveda "Jara"* is incorporated at 7th number among its eight branches. In advance age body loses its ability to maintain homeostasis. We can understand this with various theories i.e. waste accumulation theory, limited number of cell division theory, hay flick limit theory, death hormone theory, somatic mutation theory, errors and repairs theory, cross linkage theory, autoimmune theory, the rate of living theory, cell ageing theory, neuroendocrine theory, free radical theory of ageing.[viii]

Yoga incorporates focused awareness through physical posture, breath control and meditation. *Yoga* and meditation optimize sleep architecture and congnitive function leading to normal function of brain eventually regularizes circadian rhythm. In a study it has been shown that chronic changes in sleep architecture are associated with compromised cognitive function scores in several measures. Circadian phase alterations influence cognitive function.[ix] *Yoga* comprises of *Asanas* (Postural activities), *Pranayama* (beath control exercises) and meditation. Studies on *sudarshana kriya* (decrease NREM increase REM) [Sulekha et.al., 2006], *vipassana* practice (increase REM sleep) [Pattanashetty et.al., 2010], om chanting [Chatterjee et.al.,2012], daily different yoga exercise of 1hr. [Bankar et.al.,2013] Proves that long term *yoga* practices improves sleep quality in elderly. Mindful meditation improves sleep architecture. Studies shows that meditation cause morphological changes in brain regions as well as functional network pointing to changes associated with brain plasticity. EEG studies in experienced meditators shown that alpha-band functional network topology is better integrated.[x] Yoga practice helps in amelioration of age related degeneration by changing cardiometabolic risk factors, autonomic function and BDNF in healthy males.[xi] In another study relationship between poor sleep quality and reduced oxygen saturation of <90% which compromised physical performance in the form of decreased grip strength, walking speed and postural instability.[xii] *Pranayam* increases tissues oxygen perfusion that leads to improved strength of respiratory muscles leads to less sleep disturbances. In elederly people due to less physical activity muscle mass and strength decreases with different *sukshma vyayama* (stretching of joints) and chair yoga protocol attributes to flexibility, prevents decline in physical function and improves quality of life. Due to *yoga* practices relaxation with reduced

responsiveness to extraneous signals may be a factor for reduced sleep disturbance. Sleep disturbance impairs psychomotor alertness which reduces cognitive functions yoga improves mood, cognitive function and relieve stress. Yoga and meditation in long practice improves glucose metabolism in brain leads to reduction in elderly cognitive decline. With long term yogic practices (Hatha yoga), Iyenger yoga structural alignment of body improves and reduce the risk of recurrent fall.[xiii] Breathing exercises increase oxygen supply to the structures in forebrain including cerebral cortex, the limbic hypothalamic structure, basal ganglia and cerebellum thus postural stability improves in old age individuals substantially.

Discussion

To our knowledge postural stability, improved cognitive functions can be achieved by yogic posture (Sukshma vyayayama- joint relaxing techniques), Iyenger yogic practices, breathing exercises (Pranayam) and mindfull meditation. As all of the above practices improve physical activity of old age individual leads to improved structural alignment, muscular mass and muscular strength that leads to less frequent falls. Because due to yoga muscle get increased oxygen perfusion. So the flexibility of muscle improves. Glucose in blood is called as diabetes harms day to day life of a person as well as glucose in brain causes substantial damage but yogic interventions improves glucose metabolism i.e leads to improved cognitive functions. Thus yogic interventions increases the homeostasis of body and thus regularize circadian rhythm so that elder individuals get more deep sleep or REM sleep substantially improves the release of happiness hormones viz. Serotonin, dopamine and quality of life improves. *Ayurvedic* principle of *Swasthasya swasthya rakshanam* is attained and the *nidans* (etiological factors) for impaired conginitive functions and frequent falls can be regularized with continue long term yogic practices.

Conclusion

Older individuals present a circadian phase move earlier or advance due to which lowest performance occur. The timing of the rhythm of locomotor activity with respect to the timing of light-dark cycle is altered in aging. Mechanisms underlying the connection between circadian/sleep dysregulation and neurodegeneration provide interesting possibilities. Considering treatment of circadian/sleep disruption alleviate symptoms of neurodegenerative disorders. Yoga incorporates postures, breathing and meditative exercises, in long term practice of yogic exercises preserve cognitive capacities. Thus further studies regarding role of yoga in elder individuals would be worthwhile.

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