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Yoga in Neurological Disorders

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Abstract

Yoga, an ancient mind-body discipline encompassing *Asana* (physical postures), *Pranayama* (breath regulation), and *Dhyana* (meditation), has gained substantial interest as a complementary therapeutic modality in neurology. Emerging evidence from clinical and neurophysiological studies suggests that *Yoga* may positively influence a range of neurological disorders, including Parkinson's disease, Alzheimer's disease, epilepsy, multiple sclerosis, stroke, and peripheral neuropathy. Reported benefits include improvements in motor coordination, cognitive performance, affective regulation, sleep quality, and health-related quality of life. Mechanistically, *Yoga* is proposed to enhance neuroplasticity, modulate the hypothalamic-pituitary-adrenal (HPA) axis, increase levels of inhibitory neurotransmitters such as γ-aminobutyric acid (GABA), and induce neuroanatomical changes, particularly in the hippocampus, prefrontal cortex, and insular regions. This review synthesizes current findings to support the incorporation of *Yoga* as an adjunctive therapy in neurorehabilitation. Nonetheless, large-scale randomized controlled trials are warranted to validate its efficacy, establish standardized intervention protocols, and elucidate precise neurobiological mechanisms**.**

Keywords: *Yoga*, Neurological disorders, Parkinson's disease, Alzheimer's disease, Epilepsy, Multiple sclerosis

Introduction:

Yoga originated around 5,000 years ago in the Indian subcontinent as a component of Ayurvedic healing practices. A 2008 report by *Yoga Journal* noted that 15.8 million Americans were practicing yoga at the time. The term "*Yoga*" comes from the *Sanskrit* word *Yukti*, meaning "union," and it refers to the goal of uniting the individual spirit (consciousness) with the Supreme Spirit (God). Ancient *Yogis* understood that achieving this ultimate spiritual connection requires a healthy body. As a spiritual discipline, *Yoga* combines mental focus through meditation and physical postures to create harmony within the body's systems. It emphasizes the mind's influence on the senses and the physical form. Because of this holistic approach, the National Centre for Complementary and Alternative Medicine classifies yoga as a form of mind-body medicine. *Yoga*, an ancient practice integrating physical postures, controlled breathing, and meditation, has gained increasing recognition within the field of neurology as a beneficial adjunct to conventional treatments for a wide range of neurological disorders. Research highlights the multifaceted positive effects of Yoga and mindfulness on the nervous system, offering both physiological and psychological benefits.[1]

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Material and Methods: A comprehensive search of electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar, was conducted to identify relevant published articles.

Discussion:

Yoga has emerged as a promising complementary approach in the management of neurological disorders, offering both physiological and psychological benefits. Its multifaceted influence on neural function, neurotransmitter balance, and brain plasticity suggests a valuable role in neurorehabilitation and symptom modulation**.**

Types of *Yoga*: *Yoga* is one of the six classical schools of Indian Vedic philosophy, collectively known as *Darshana*. *Maharishi Patanjali*, recognized as the "Father of *Yoga*," systematically compiled its principles in his foundational text, the *Yoga Sutras*. In this work, he outlined the eight-fold path known as *Ashtanga Yoga*, aimed at the comprehensive development of an individual's personality. This path consists of *Yama* (moral restraints), *Niyama* (personal observances), *Asana* (physical postures), *Pranayama* (breath regulation), *Pratyahara* (sensory withdrawal), *Dharana* (concentration), *Dhyana* (meditative absorption), and *Samadhi* (spiritual transcendence). These stages reflect deep psychological understanding of human nature and behaviour. Alongside the eight-fold path, *Yoga* philosophy is further divided into four primary paths or streams: action, devotion, knowledge, and mental discipline. *Karma Yoga*, the path of selfless action, teaches individuals to perform their duties wholeheartedly and joyfully, without attachment to the outcomes, thereby freeing the mind and increasing effectiveness. *Bhakti Yoga*, the path of devotion, involves directing one's emotions and thoughts toward divine love, which soothes emotional disturbances and fosters inner tranquillity. *Gyana Yoga,* or the path of knowledge, encourages introspection and deep contemplation to uncover spiritual truths and dispel *Avidya* (ignorance), enabling the mind to achieve its natural state of clarity and calm. *Raja Yoga*, the path of mental control or psychic discipline, offers a systematic method for mastering the mind. Based on *Patanjali's* eight-fold path, it leads practitioners on a progressive journey of mental refinement and spiritual realization.

The clinical role of *Yoga* on neurological disorders:

Yoga and headaches:

Multiple studies have indicated that *Yoga* can be beneficial in reducing both the frequency and intensity of various types of headaches, especially migraines and tension-type headaches.[2] *Yoga* has been proposed as a promising complementary therapy for managing headaches. A meta-analysis examining the effects of *Yoga* on tension-type headaches and migraines provided preliminary evidence of *Yoga*'s short-term benefits, particularly in reducing the frequency, duration, and intensity of tension-type headaches.

Several studies have investigated the underlying mechanisms through which *Yoga* may influence headache relief. Migraine, a neurovascular disorder characterized by increased expression of endothelial adhesion molecules, appears to respond positively to *Yoga* practice. It is believed that yoga alleviates headache symptoms primarily by modulating the brain's pain perception pathways, involving key regions such as the anterior cingulate cortex, insula, sensory cortex, and thalamus.[3]

Yoga and Alzheimer's disease:

Alzheimer's disease (AD) is marked by the degeneration and loss of neurons, particularly in the neocortex and hippocampus, leading to memory loss, cognitive decline, and various neuropsychiatric disturbances.[4] *Yoga* practice has been shown to enhance cognitive function, emotional regulation, and physical abilities in healthy older adults. In individuals with mild cognitive impairment, *Yoga* has a positive effect on overall brain volume, increases neocortical grey matter thickness, and improves functional connectivity between various brain regions. By increasing blood flow to brain areas involved in memory processing, yoga may help reduce neuronal damage, alleviate early symptoms of dementia, and potentially delay the onset of Alzheimer's disease. Additionally, *Yoga* can improve physical impairments associated with AD, including walking ability, gait speed, and balance.[5] Although the exact mechanisms by which yoga affects Alzheimer's disease (AD) are not yet fully understood, several potential pathways have been proposed. One such mechanism involves the increase in serum levels of neurotrophic factors, such as brain-derived neurotrophic factor (BDNF), which has been observed following *Yoga* practice in healthy individuals. BDNF plays a crucial role in supporting neuronal survival, enhancing synaptic plasticity, and promoting cognitive function all of which may contribute to *Yoga's* beneficial effects on brain health in the context of AD[6]

Yoga and epilepsy:

The primary objective of therapeutic strategies for epilepsy a prevalent neurological disorder marked by abnormal electrical activity in the brain is to reduce or eliminate the frequency and duration of seizures while enhancing the overall quality of life for affected individuals.[7]

Several studies indicate that yogic practices may help reduce seizure activity in individuals with various forms of epilepsy. One study investigating the impact of *Yoga* intervention on seizures and EEG patterns in 32 patients with idiopathic epilepsy reported a reduction in seizure frequency by 62% after 3 months and by 83% after 6 months of *Yoga* practice. Additionally, the study demonstrated a significant shift in EEG frequency, moving from the 0–8 Hz range toward the 8–20 Hz range, suggesting improved brain activity and stability.[8]

Yoga and multiple sclerosis:

Multiple sclerosis (MS) is an autoimmune, neuroinflammatory, demyelinating disorder of the central nervous system. *Yoga* interventions have shown beneficial effects in individuals with MS, particularly in improving postural balance and reducing the impact of balance impairments on daily activities. Notably, a six-month *Yoga* practice led to significant improvements in these areas, enhancing the overall functional ability and quality of life in patients with MS.[9]

Yoga and Parkinson's disease:

The potential therapeutic benefits of *Yoga* for Parkinson's disease (PD) a chronic, progressive neurodegenerative disorder have been the focus of several studies. *Yoga* has been found to positively impact a variety of PD symptoms, offering improvements in motor function, balance, flexibility, and overall quality of life. Additionally, it may help reduce non-motor symptoms such as anxiety, depression, and sleep disturbances, making it a valuable complementary approach in the management of PD.[10] *Yoga* and meditation have been shown to be effective in alleviating both motor and non-motor symptoms of neurological disorders. These practices can improve motor functions such as balance, coordination, and

flexibility, while also helping to reduce non-motor symptoms including fatigue, sleep disturbances, and pain.[11]

Yoga exercises have been found to enhance flexibility and balance, reduce muscle rigidity, improve range of motion, and strengthen muscles in individuals with Parkinson's disease (PD). Regular *Yoga* practice also helps alleviate back pain related to postural instability, potentially lowering the risk of falls in PD patients. Moreover, when used as an adjunctive therapy, *Yoga* has been shown to effectively reduce psychological complications, especially anxiety and depression, thereby contributing to overall well-being and quality of life.[12]

Yoga and neuropathy:

Peripheral neuropathy is a prevalent neurological condition resulting from various causes, including physical nerve injury, diabetes mellitus, autoimmune disorders, malignancies, kidney failure, nutritional deficiencies, systemic diseases, and idiopathic factors. It can affect motor, sensory, and autonomic peripheral nerves, leading to a wide range of functional impairments. [13] *Yoga* practices have been shown to alleviate numbness and weakness in the lower limbs following stretch or compression injuries to the gluteal nerves. In individuals with diabetic neuropathy, yoga has helped reduce chronic pain and enhance both sensory function and muscle movement. Additionally, yoga may relieve pressure in conditions like carpal tunnel syndrome by reducing nerve compression, potentially leading to noticeable improvement in numbness within a few weeks of consistent practice.[14]

Yoga and meditation therapy have been shown to improve nerve conduction velocity in patients with diabetic neuropathy. This improvement is closely associated with better glycemic control, suggesting that regular practice may contribute to enhanced nerve function alongside metabolic regulation.

Yoga in epilepsy:

Epilepsy is a chronic neurological disorder characterized by a tendency to experience recurrent seizures. The type and frequency of seizures can vary significantly among individuals, but the condition often impacts personal life, health, and professional functioning. While a range of medications is available to help manage seizures, the primary goal of treatment is to reduce seizure frequency and duration, and to enhance overall quality of life (QOL). However, many anti-seizure medications come with side effects, making it desirable to explore alternative or complementary therapies that could help control seizures and potentially reduce medication dependence.

One such approach is *Sahaja Yoga* Meditation, which has demonstrated promising results. Studies have shown that practicing Sahaja Yoga can lead to significant improvements in Visual Contrast Sensitivity and the Na-Pa amplitude of Mid Latency Responses (MLR) in individuals with primary idiopathic epilepsy. These findings suggest a positive effect on neural processing and sensory perception, indicating the potential of this meditative practice as a supportive therapy in epilepsy management. [15]

Yoga in dementia:

A twelve-week Silver *Yoga* program, practiced three times per week, has been shown to significantly improve both physical and mental health in elderly individuals with dementia residing in long-term care facilities. Physically, participants experienced lowered blood pressure, reduced respiratory rate, enhanced cardiopulmonary fitness, increased body flexibility, improved muscle strength and endurance, better balance, and greater joint mobility. Mentally, there was a notable reduction in depressive symptoms and

problematic behaviours. Based on these positive outcomes, incorporating Silver *Yoga* as a regular activity in long-term care settings is strongly recommended.[16]

Mechanisms of Action:

Reduction of Stress Hormones: Regular *Yoga* practice lowers cortisol and other stress hormones, helping to modulate the body's stress response. This is particularly relevant in neurological conditions where stress can exacerbate symptoms.

Yoga is a holistic practice that integrates both the mind and body, with its roots in ancient India. Over time, it has gained widespread popularity across the globe. In Western culture, *Yoga* is often viewed primarily as a form of relaxation and physical exercise, emphasizing stretching and controlled breathing techniques. Among its various components, *Asana* (physical postures) and *Pranayama* (breath control) have become the most widely practiced and recognized elements of *Yoga* in the West.[17]

Enhancement of Neuroplasticity: *Yoga* has been shown to promote **neuroplasticity**, the brain's capacity to reorganize and adapt by forming new neural connections. This enhanced adaptability supports recovery and functional improvement in various neurological conditions, including stroke, traumatic brain injury, and neurodegenerative disorders. By engaging both physical and mental aspects of the nervous system, yoga helps stimulate neural pathways that aid in healing, adaptation, and the maintenance of cognitive and motor functions.[18]

Improved Sleep and Mood: Both *Yoga* and mindfulness practices have been shown to enhance sleep quality and alleviate symptoms of depression and anxiety common comorbidities associated with various neurological disorders. By promoting relaxation, emotional regulation, and overall mental well-being, these practices serve as effective complementary therapies for supporting neurological health.

Neurochemical Modulation: *Yoga* has been found to increase levels of inhibitory neurotransmitters such as GABA (gamma-aminobutyric acid), which plays a key role in regulating neural activity and reducing anxiety. Additionally, *Yoga* enhances the production of dopamine and serotonin, neurotransmitters associated with improved mood, emotional well-being, and cognitive function. These neurochemical changes contribute to *Yoga's* therapeutic benefits for mental and neurological health.[19]

Structural Brain Changes: Long-term *Yoga* practice has been linked to increased gray matter volume (GMV), especially in the hippocampus, a brain region essential for memory and learning. This structural enhancement may contribute to improved cognitive function and offer protective effects against age-related cognitive decline and neurodegenerative diseases, such as Alzheimer's disease.[20]

Effect of Yoga on brain neurotransmitters:

γ-aminobutyric acid (GABA) is recognized as the primary inhibitory neurotransmitter responsible for regulating cortical excitability and neural plasticity. A growing body of evidence suggests that *Yoga* enhances cortical GABAergic inhibitory tone and influences related brain regions. For instance, a 12-week *Yoga* intervention significantly increased thalamic GABA levels, which was associated with improved mood and reduced anxiety. This elevation in thalamic GABA may be attributed to enhanced regional cerebral blood flow in the prefrontal cortex among yoga practitioners, potentially leading to the activation of the thalamic reticular nucleus and increased GABA production.

Magnetic resonance spectroscopy (MRS) studies have further demonstrated that individuals who practiced yoga exhibited higher brain GABA levels following a 60-minute *Yoga* session compared to non-practicing controls. In addition to GABA, increases in dopamine have been observed in the ventral striatum of yoga practitioners. *Yoga* is also believed to promote a rise in serotonin levels. Several studies measuring

serotonin metabolites in urine after meditation sessions have reported elevated levels. Furthermore, consistent *Yoga* practice may contribute to a decrease in norepinephrine levels. For example, patients with heart failure who engaged in weekly *Yoga* sessions showed reduced norepinephrine concentrations in their blood samples.[21]

Conclusion:

Based on the existing literature, *Yoga* appears to be a potentially effective supportive therapy for individuals with a range of neurological disorders, such as, Parkinson's disease, multiple sclerosis, Alzheimer's disease, headaches, and neuropathies. At the same time, proper care should be taken to avoid untoward effects while performing advanced *Yoga* practices. Many studies show *Yoga* benefits neuropsychological disorders, but evidence on its usefulness especially meditation for clinicians remains limited. Many investigations lack rigorous design, have small samples, short follow-ups, poor controls, and varied interventions, leading to inconsistent outcomes. Differences in *Yoga* types, duration, and measurement tools contribute to result heterogeneity. Standardized, well-defined methods and accurate population selection are essential to assess *Yoga's* true therapeutic value.

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