



## The Neurotransmitter (Gaba) & Yoga

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<i>Article History</i>	<i>Abstract</i>
Received: 2/9/2022 Revised: 4/10/2022 Accepted: 20/11/2022  <b>CC License</b> CC-BY-NC-SA 4.0	Yoga is an ancient practice that involves movement, meditation, and breathing techniques to promote mental and physical wellbeing. The overall philosophy of yoga is about connecting the mind, body, and spirit. Today, yoga is a popular form of exercise across the world. The various methods of yoga have many benefits in the recovery process, including relieving stress, decreasing anxiety, and even promoting changes in the brain.

### What Is GABA?

GABA, or gamma-aminobutyric acid, is a naturally occurring amino acid that works as a neurotransmitter in your brain. Neurotransmitters function as chemical messengers, and GABA is considered an inhibitory neurotransmitter. GABA blocks specific brain signals and decreases activity in the nervous system. When GABA attaches to the protein GABA receptor, it produces a calming effect. This calming effect can help reduce feelings of anxiety, stress, fear, and may even help prevent seizures. As a result of this, GABA has become a popular supplement.

It is a neurotransmitter of major significance in the brain, being released by up to 40% of neurons to activate chloride channels [1]. This process generally results in inhibition of neuronal firing. GABA also has an important role in brain metabolism with up to 30% of the turnover to the tricarboxylic acid cycle in brain going via the GABA shunt. So, on the numbers, it is no surprise that yoga is associated somehow with GABA mechanisms. What is the science behind this association?

The balance between inhibition mediated by GABA and excitation by L- glutamate is vital to brain function. Too much inhibition or too little excitation may be equated with depression, anaesthesia and coma. Too much excitation or too little inhibition may be equated with anxiety, hyperexcitability, epilepsy and convulsions. Yoga has been shown to influence this balance. Emerging evidence from recent clinical in vivo experiments suggests that yoga improves GABA- mediated cortical-inhibitory tone [2]. The antianxiety action of benzodiazepines is known to result from increasing the action of GABA on certain of its receptors in the brain.

### Influence of Yoga on Stress

Evidence points to yoga reducing stress, which often involves changes in levels of the stress hormone cortisol. GABA receptors are known to be influenced by stress and stress hormones such as cortisol. Agents Available online at: <https://jazindia.com>

known to influence stress have been shown to act directly on GABA receptors, including medications such as benzodiazepines. However, yoga has been described as a non-pharmacological alternative to benzodiazepines to treat anxiety. When yoga works to increase GABA levels, the increased activity of GABA results in the relief of anxiety and stress.

### **Depression, Yoga, and GABA**

A recent study published by the Boston University School of Medicine found that yoga can increase GABA in the short term. They concluded that one yoga class per week could even help maintain elevated GABA levels and, in turn, could help relieve depression symptoms.

In the study, a group of 30 individuals diagnosed with depression were randomly divided into two groups. Both groups engaged in two types of yoga: Iyengar yoga and coherent breathing - with the only difference being the number of sessions each group participated in. Over three months, one group was assigned three yoga sessions per week, while the other group was given only two sessions per week. The participants underwent magnetic resonance imaging (MRI) scans of their brains before the first yoga session and after the last yoga session. They also completed a clinical depression scale to monitor their symptoms.

The study results found that both groups experienced an improvement in their depression symptoms after three months. MRI scans found that, after three months, GABA levels were elevated compared to the first MRI scan before starting the yoga sessions. However, GABA levels only remained at an increase for four days after the last session; after eight days, the increase was no longer observed. According to Chris Streeter, MD, associate professor at Boston University School of Medicine, "The study suggests that the associated increase in GABA levels after a yoga session are 'time-limited' similar to that of pharmacologic treatments such that completing one session of yoga per week may maintain elevated levels of GABA."

### **Yoga Increases GABA in the Brain**

Our most direct understanding of the association between yoga and GABA comes from the work of Streeter and colleagues. They used magnetic resonance spectroscopy to measure GABA levels in the brain. In an early study they compared the effect of a 60-minute yoga session by yoga practitioners with a 60-minute reading session by comparator subjects on brain GABA levels. They found a significant 27% increase in brain GABA levels following 60 minutes of yoga compared to baseline (pre-yoga session) but no change from baseline in the comparator group [8]. In another study, participants who undertook twelve weeks of yoga (60 minutes three times a week) demonstrated greater improvement in mood and reduction in anxiety compared with subjects who participated in twelve weeks of walking (60 minutes three times a week) [9]. Yoga was also associated with increased GABA release in the thalamus as measured by MRI, and this increase was correlated with improved mood and reduced anxiety [8]. They recently extended these studies to show a 12-week Iyengar yoga and coherent breathing intervention (two to three sessions per week) in participants diagnosed with major depressive disorder significantly increased GABA levels in the thalamus, concurrent with an increase in mood as measured by the Beck Depression Inventory II [10]. The observed increase in GABA levels was no longer observed 8 days after yoga intervention, suggesting that at least one intervention a week may be necessary to maintain elevated GABA levels. As the authors comment, magnetic resonance spectroscopy is limited by only measuring the presence of GABA, not cellular location or receptor activity. Thus, the improvement in mood and reduction in anxiety gained from yoga may be due in part to increased thalamic GABA release. Elevation of GABA levels following acute and chronic yoga practice also points towards yoga practice as effective treatment for "low GABA states" such as depression and anxiety [8].

Where does the increased GABA come from? GABA in the brain turns over quite rapidly. If the synthesizing enzyme L-glutamate decarboxylase is blocked, it takes only some 30 minutes for the levels of GABA to drop such that convulsions occur. Conversely if the metabolizing enzyme GABA transaminase is blocked, GABA levels build up such that enzyme blockers are anticonvulsants. GABA exists in different pools in the brain that turnover at different rates and have multiple roles-transmitter, metabolite and trophic factor [11]. Thus, increased GABA associated with yoga could result from decreased metabolism of GABA or increased synthesis. Neuroimaging studies have suggested that activation of the prefrontal cortex during or after yoga may increase L-glutamate stimulating the thalamic increase in GABA [12]. A variety of neuroimaging techniques have revealed information on the regions of the brain influenced by yoga. Rather less information has been revealed about brain metabolites and neurotransmitters. A PET study has provided interesting findings on dopamine release using a  $^{11}C$ -probe [12]. Similar studies need to be undertaken with GABA.

Various other studies have shown an association between yoga and increased GABA levels. One study used magnetic resonance spectroscopy to measure GABA levels in the brain. Researchers compared the effects of a 60-minute yoga session by yoga practitioners with a 60-minute reading session by comparator subjects on GABA levels in the brain. The results found a 27% increase in GABA levels following 60 minutes of yoga than before a yoga session.

They found no change in the comparator group. In another study, participants who went through twelve weeks of yoga (60 minutes three times a week) demonstrated more significant improvement in mood and reduced anxiety than participants who engaged in twelve weeks of walking (60 minutes three times a week).

### **Parasympathetic vagal afferents and the brain-gut axis**

Increased thalamic GABA possibly could come from outside the brain via stimulation of parasympathetic vagal afferents from the thoracic and abdominal viscera synapsing back onto the central nervous system. Vagal afferent neurons originating from pharynx, larynx, trachea, thoracic and abdominal viscera synapse on the brainstem nucleus tractus solitaries, which projects to the thalamus as well as areas of the brain known to regulate stress (e.g. hippocampus and hypothalamus), responses to threat (e.g. amygdala), and autonomic and HPA axis outputs [13]. GABA interneurons and GABA receptors are integral to these brain regions, hence regulation of the stress response. Streeter et al. [13] have hypothesized that the stress-induced imbalance in autonomic function leads to underactivity of the GABA system. Yoga-based practices correct underactivity of the PNS and GABA systems in part through stimulation of the vagal afferents to synapse on key brain areas that increase GABA levels, hence reduce stress and anxiety. Since vagal tone correlates with capacity to regulate stress responses and is influenced by breathing, an increase in vagal tone through yoga maybe a basis for the mitigation of anxiety disorders [14].

GABA is extensively distributed within the enteric nervous system and is an important postbiotic, a metabolite of gut microbiota [14-16]. It is interesting that chronic treatment of mice with GABA-producing Lactobacilli, has been shown to reduce anxiety behaviours in the elevated plus maze and fear conditioning task [17]. Gut microbes are known to affect the brain and behaviour via the vagus [18] to influence disorders mediated by the gut-brain axis including depression and anxiety [14,15]. Based on evidence that exercise modifies gut microbiota composition contingent upon sustainment of the exercise [19, 20], it is reasonable that yogainduced alterations to gut microbiome and GABA concentrations may contribute to the GABA-elevating and stress-reducing effects of yoga practice.

### **Conclusion**

Current evidence strongly implicates increased GABA function as a result of yoga practice as contributing to the beneficial effects of GABA through reducing stress and anxiety. However, further mechanistic insights are needed of GABA metabolism using advanced brain imaging and of how parasympathetic vagal afferents and the gut microbiome regulate brain GABA in yoga. These concepts and their advancement will strengthen the message that improved GABA function contributes to the behavioral benefits of yoga.

Many treatment programs introduce clients to yoga due to its various benefits to the recovery process. Yoga can bring physical, mental, and spiritual benefits; it can even produce changes in the brain. Multiple studies have shown the relationship between yoga and GABA, a neurotransmitter that produces calming effects. The increase in GABA presented by yoga can help relieve depression symptoms, stress levels, and anxiety. At West Coast Recovery Centers, we have seen the benefits of yoga in recovery, which is why we choose to implement the practice into our treatment plans. Through various traditional and non-traditional therapeutic modalities, West Coast Recovery Centers will create an individualized treatment plan that will fit your needs. We believe that genuine individualized care fosters a more profound and more effective healing process. That's why we're passionate about building an intimate recovery community, so no one is ever lost in translation.

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