

## Yoga Can Change Your Brain: A Review of Research Provides Preliminary Evidence

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Studies are beginning to show that yoga practices can change your brain. A recent review of the literature in *Complementary Therapies in Clinical Practice* suggests that yoga may change not only brain structure but brain waves as well.

A group of researchers compiled all of the research published in English between 1990 and 2014 that focused on either a yoga intervention or a comparison of yoga to non-yoga practitioners. Their goal was to understand the effects of yoga on brain waves and structural changes in brain activation.

Their analysis included 15 studies that examined alterations in brain waves, structural activation or other brain changes following participating in yoga postures (*asana*), breathing exercises (*pranayama*), and "meditation-based yoga." Studies could include one of a number of brain imaging techniques such as magnetic resonance imaging (MRI), functional magnetic resonance imaging (fMRI) or positron emission topography (PET scans). All 3 methods are commonly employed in brain research.

### Yoga Changes Brain Wave Activity

Different types of brain wave activity are associated with a variety of different cognitive and emotional functioning. For example, *alpha waves* (8-13Hz frequency) are low amplitude signals that occur when a person is resting but still alert. Alpha waves are linked to decreased pain and discomfort, but also related to increased memory retrieval, improved word recognition, and the perception of calmness.

*Beta waves* (12-38 Hz) on the other hand occur during heightened states of awareness, and are associated with active concentration. Previous research correlates higher beta wave activation with increased academic performance, as well as decreased emotional exhaustion, generalized fatigue and state anxiety.

*Theta waves* (4-7 Hz) arise in the presence of repetitive tasks or when someone has established a relatively predictable routine. They are linked to short-term memory functioning. Like alpha waves, theta waves are associated with reduce anxiety.

When considering brain waves from the perspective of attention, concentration and relaxation it is easy to see why the relationship between yoga practices and brain waves presents an interesting proposition.

After reviewing and evaluating the literature researchers drew several conclusions:

1. Although the studies were of varying quality, there is general support for yoga practices (movement, breath exercises and meditation) being associated with positive brain states.
2. Changes in alpha brain waves associated with decreased pain and increased calmness were found after breathing, meditation and posture-based yoga practices.
3. Increases in beta wave activation, which is linked with improved task performance, were related primarily to breathing based yoga (*pranayama*). These included practices designed to achieve both activation (e.g. *Kapalabhati*) and relaxation (e.g. *Anuloma Ujjayi*).
4. Theta wave activation, which is associated with repetitive tasks, decreases in anxiety and increases in focus, was found to increase after both *asana* (posture-based) and *pranayama* (breathing-oriented) practices.

### Yoga and Structural Brain Changes

There is growing evidence of the relationship between regular yoga practice and improved mood, memory, and decreased perceptions of pain. Much of these experiences are controlled by the amygdala -

a small, relatively round structure just adjacent to the hippocampus. The amygdala is the integrative center for emotions, emotional behavior, and motivation.

One study of Iyengar yoga students found decreased blood flow to the amygdala after 12-weeks of training. Increased cerebral blood flow to regions of the frontal lobes of the brain that are related to persistent focus and attention were also reported. Other studies suggest increased brain volume (which implies increased activation) in the frontal lobes of yoga and meditation practitioners.

Increases in the volume of gray matter in the hippocampus have also been detected following asana-based and pranayama-based yoga practices. The hippocampus is responsible for the consolidation of short-term memory into long-term memory as well as spatial navigation. This could be particularly important as reductions in hippocampal volume/hippocampal atrophy, are associated with a number of degenerative brain disorders associated with aging (i.e. Alzheimer's Disease, Parkinson's Disease and dementia).

Lastly, there is some evidence that individuals who had practiced yoga at least 4-10 times per week for 6-11 years had increased gray matter in the insular cortex. This increased volume was associated with a higher pain threshold when exposed to a pain-inducing, temperature-related stimulus.

## Potential Benefits of Yoga for Clinical Populations

It is important to note that the studies reviewed were conducted with healthy young and older adults and not clinical populations. While it is possible that yoga postures, breathing exercises and meditation may be of benefit, findings from this review alone are not conclusive.

Nevertheless, there are some promising avenues that would benefit from further investigation.

1. Yoga may be of particular benefit to individuals with pain and anxiety, both of which are associated with alpha wave stimulation, which is known to increase following yoga postures, breathing exercises and meditation.
2. Amplified beta wave activation and enlarged hippocampal volume following yoga practice suggest that yoga may be particularly helpful for elderly populations and those experiencing cognitive decline.
3. In general, these findings suggest that yoga practices are associated with increased positive mood. This may be particularly useful for individuals dealing with mild to moderate depressive symptoms, anxiety, stress, pain, and physical conditions or illnesses that benefit from mood management.

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## Sources

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