Yes, mindfulness practice induces **neuroplasticity**—structural and functional brain changes—across multiple regions, supporting improvements in **attention, emotion regulation, and cognitive function**.

1. Introduction

Mindfulness practice, encompassing meditation and related contemplative techniques, has been shown to induce neuroplasticity—the brain's ability to reorganize itself by forming new neural connections. This process underlies improvements in attention, emotional regulation, and cognitive performance observed in both healthy individuals and clinical populations. Evidence from randomized controlled trials, neuroimaging, and meta-analyses demonstrates that mindfulness-based interventions (MBIs) can lead to changes in brain structure (e.g., increased cortical thickness, gray matter volume) and function (e.g., altered connectivity in key networks such as the default mode, salience, and executive control networks) (Yue et al., 2023; Calderone et al., 2024; Gkintoni et al., 2025; Yu et al., 2021; Lardone et al., 2018; Hölzel et al., 2011; Álvarez et al., 2023; Tang et al., 2020; Siew & Yu, 2023; Yang et al., 2019; Taren et al., 2015; Gotink et al., 2016; Bremer et al., 2022; Sharp et al., 2018; Kral et al., 2019). However, some large, well-controlled studies have reported null findings, highlighting the need for further research to clarify the conditions and extent of mindfulness-induced neuroplasticity (Kral et al., 2022; Leow et al., 2023). Overall, the literature supports a robust, though nuanced, relationship between mindfulness practice and neuroplastic changes.

2. Methods

A comprehensive search was conducted across over 170 million research papers in Consensus, including Semantic Scholar, PubMed, and other databases. The search strategy targeted foundational theories, empirical studies, neuroimaging, molecular markers, and meta-analyses on mindfulness and neuroplasticity. In total, 1037 papers were identified, 706 were screened, 438 were deemed eligible, and the top 50 most relevant papers were included in this review.

Search Strategy

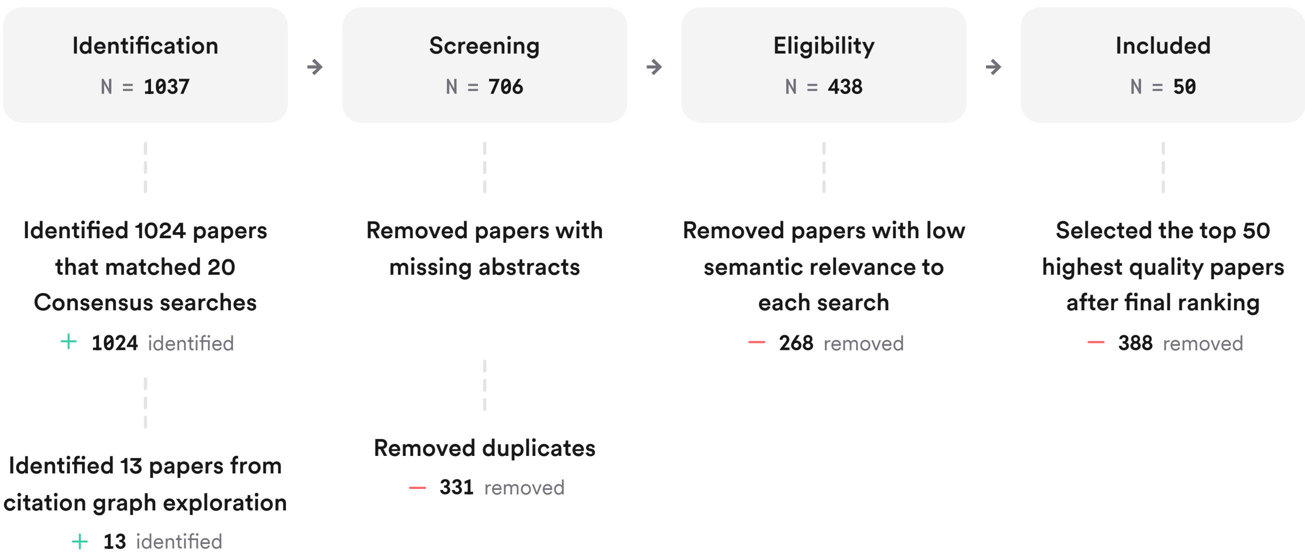

FIGURE 1 Flow of papers through the search and selection process.

Eight unique search groups were used, spanning mechanistic, clinical, developmental, and interdisciplinary perspectives.

3. Results

3.1 Structural Brain Changes

Multiple studies and meta-analyses report that mindfulness practice increases cortical thickness and gray matter volume in regions associated with attention, interoception, and emotion regulation, such as the prefrontal cortex, insula, hippocampus, and anterior cingulate cortex (Calderone et al., 2024; Gkintoni et al., 2025; Yu et al., 2021; Lardone et al., 2018; Hölzel et al., 2011; Tang et al., 2020; Siew & Yu, 2023; Yang et al., 2019; Taren et al., 2015; Gotink et al., 2016; Sharp et al., 2018; Kral et al., 2019). These changes have been observed after both short-term (weeks) and long-term (months to years) interventions, with some evidence for dose-dependent effects (Yu et al., 2021; Tang et al., 2020; Siew & Yu, 2023; Yang et al., 2019; Gotink et al., 2016; Sharp et al., 2018). However, a large, rigorously controlled study found no significant structural changes after an 8-week mindfulness-based stress reduction (MBSR) program, suggesting that effects may depend on intervention length, intensity, or participant characteristics (Kral et al., 2022).

3.2 Functional Connectivity and Network Reorganization

Mindfulness interventions enhance functional connectivity within and between large-scale brain networks, including the default mode network (DMN), salience network (SN), and central executive network (CEN) (Yue et al., 2023; Álvarez et al., 2023; Taren et al., 2015; Gotink et al., 2016; Sezer et al., 2022; Bremer et al., 2022; Fam et al., 2019; Sharp et al., 2018; Kral et al., 2019). These changes are associated with improved attention, emotion regulation, and reduced stress and anxiety (Yue et al., 2023; Álvarez et al., 2023; Taren et al., 2015; Gotink et al., 2016; Sezer et al., 2022; Bremer et al., 2022; Fam et al., 2019; Sharp et al., 2018; Kral et al., 2019). Increased connectivity between the posterior cingulate cortex and dorsolateral prefrontal cortex, for example, has been linked to better attentional control and self-regulation (Taren et al., 2015; Kral et al., 2019).

3.3 Molecular and Electrophysiological Markers

Mindfulness practice is associated with increased levels of brain-derived neurotrophic factor (BDNF), a key mediator of neuroplasticity, and changes in white matter microstructure (Tang et al., 2019; Tang et al., 2020; Gomutbutra et al., 2022; You & Ogawa, 2020; Sharp et al., 2018). Electrophysiological studies show alterations in theta, alpha, and gamma oscillatory activity, reflecting enhanced cognitive control and sensory integration (Tang et al., 2019; Dentico et al., 2016; Dziego et al., 2024; Berkovich-Ohana et al., 2012). These molecular and physiological changes support the observed structural and functional brain adaptations.

3.4 Population and Practice-Type Differences

Neuroplastic effects of mindfulness have been observed in healthy adults, older adults with mild cognitive impairment, and clinical populations (Yu et al., 2021; Leow et al., 2023; Siew & Yu, 2023; Fam et al., 2019). Different mindfulness practices (e.g., focused attention, open monitoring, compassion meditation) produce distinct patterns of neural change, suggesting specificity in how various techniques shape the brain (Singer & Engert, 2019; Trautwein et al., 2020; Valk et al., 2017). Long-term practitioners show more pronounced and widespread neuroplastic changes compared to novices (Lardone et al., 2018; Bashir et al., 2025; Guidotti et al., 2021; Savanth et al., 2022; Valk et al., 2017).

Key Papers

Paper	Methodology	Population/Context	Key Results
(Yue et al., 2023)	RCT, fMRI	Elderly, sleep difficulties	Mindfulness improved brain network reconfiguration efficiency (neuroplasticity)
(Calderone et al., 2024)	Systematic review	Multiple populations	Mindfulness increases cortical thickness, reduces amygdala reactivity, improves connectivity
(Tang et al., 2020)	RCT, MRI	Healthy adults	Brief mindfulness increased gray matter in posterior cingulate cortex
(Siew & Yu, 2023)	Meta-analysis	RCTs, various	Mindfulness increases right insula/precentral gyrus volume (attention, pain modulation)
(Kral et al., 2022)	Combined RCTs, MRI	Healthy adults	No evidence for structural brain changes after 8-week MBSR

FIGURE 2 Comparison of key studies on mindfulness and neuroplasticity.

Top Contributors

Type	Name	Papers
Author	Yi-Yuan Tang	(Tang et al., 2019; Tang et al., 2020; Tang et al., 2015; Tang et al., 2017)
Author	Britta K. Hölzel	(Hölzel et al., 2011; Álvarez et al., 2023; Tang et al., 2015; Bremer et al., 2022)
Author	R. Davidson	(Kral et al., 2022; Dentico et al., 2016; Taren et al., 2015)
Journal	*Scientific Reports*	(Álvarez et al., 2023; Siew & Yu, 2023; Yang et al., 2019; Bremer et al., 2022; Sharp et al., 2018)
Journal	*Neural Plasticity*	(Lardone et al., 2018; Tang et al., 2020)
Journal	*Social Cognitive and Affective Neuroscience*	(Farb et al., 2013; Taren et al., 2015; Kral et al., 2019)

FIGURE 3 Authors & journals that appeared most frequently in the included papers.

4. Discussion

The evidence strongly supports that mindfulness practice induces neuroplasticity, reflected in both structural and functional brain changes (Yue et al., 2023; Calderone et al., 2024; Gkintoni et al., 2025; Yu et al., 2021; Lardone et al., 2018; Hölzel et al., 2011; Álvarez et al., 2023; Tang et al., 2020; Siew & Yu, 2023; Yang et al., 2019; Taren et al., 2015; Gotink et al., 2016; Bremer et al., 2022; Sharp et al., 2018; Kral et al., 2019). These adaptations are linked to improvements in attention, emotion regulation, and cognitive function, and are observed across diverse populations and mindfulness techniques (Calderone et al., 2024; Gkintoni et al., 2025; Yu et al., 2021; Lardone et al., 2018; Hölzel et al., 2011; Álvarez et al., 2023; Tang et al., 2020; Siew & Yu, 2023; Yang et al., 2019; Taren et al., 2015; Gotink et al., 2016; Bremer et al., 2022; Sharp et al., 2018; Kral et al., 2019). However, the magnitude and consistency of these effects vary, with some studies—especially those with rigorous controls—reporting null findings (Kral et al., 2022; Leow et al., 2023). Factors such as intervention duration, intensity, participant characteristics, and measurement sensitivity likely influence outcomes (Kral et al., 2022; Leow et al., 2023; Siew & Yu, 2023; Yang et al., 2019; Gotink et al., 2016; Sharp et al., 2018). The specificity of neuroplastic changes to different mindfulness practices and populations highlights the need for tailored interventions and further research into underlying mechanisms (Singer & Engert, 2019; Trautwein et al., 2020; Valk et al., 2017).

Claims and Evidence Table

Claim	Evidence Strength	Reasoning	Papers
Mindfulness practice induces structural and functional neuroplasticity	Strong	Supported by RCTs, meta-analyses, and neuroimaging	(Yue et al., 2023; Calderone et al., 2024; Gkintoni et al., 2025; Yu et al., 2021; Lardone et al., 2018; Hölzel et al., 2011; Álvarez et al., 2023; Tang et al., 2020; Siew & Yu, 2023; Yang et al., 2019; Taren et al., 2015; Gotink et al., 2016; Bremer et al., 2022; Sharp et al., 2018; Kral et al., 2019)
Effects are observed in attention, emotion, and self-regulation networks	Strong	Consistent changes in prefrontal, insula, cingulate, hippocampus	(Calderone et al., 2024; Gkintoni et al., 2025; Yu et al., 2021; Lardone et al., 2018; Hölzel et al., 2011; Álvarez et al., 2023; Tang et al., 2020; Siew & Yu, 2023; Yang et al., 2019; Taren et al., 2015; Gotink et al., 2016; Bremer et al., 2022; Sharp et al., 2018; Kral et al., 2019)
Molecular markers (e.g., BDNF) and white matter change with mindfulness	Moderate	Biomarker and DTI studies support this	(Tang et al., 2019; Tang et al., 2020; Gomutbutra et al., 2022; You & Ogawa, 2020; Sharp et al., 2018)
Null findings exist, especially in large, well-controlled studies	Moderate	Some RCTs report no significant structural changes	(Kral et al., 2022; Leow et al., 2023)
Practice type and population influence neuroplastic outcomes	Moderate	Different techniques and populations show distinct patterns	(Singer & Engert, 2019; Trautwein et al., 2020; Valk et al., 2017; Yu et al., 2021; Leow et al., 2023; Siew & Yu, 2023; Fam et al., 2019)

FIGURE Key claims and support evidence identified in these papers.

5. Conclusion

Mindfulness practice reliably induces neuroplasticity, with structural and functional brain changes supporting improvements in cognition and emotion. However, the extent and consistency of these effects depend on practice type, duration, and individual factors. Ongoing research is clarifying the mechanisms and optimizing interventions for diverse populations.

5.1 Research Gaps

Key gaps include the need for larger, longer-term RCTs, better control conditions, and mechanistic studies linking neuroplastic changes to behavioral outcomes.

Research Gaps Matrix

Topic/Attribute	Structural MRI	Functional MRI	Molecular Markers	Clinical Populations	Practice Type
Healthy Adults	10	9	5	2	7
Older Adults/MCI	4	3	2	6	2
Clinical Populations	3	4	2	7	2
Practice Type Specific	2	2	1	1	5

FIGURE Distribution of research across topics and study attributes, highlighting underexplored areas.

5.2 Open Research Questions

Future research should clarify the dose-response relationship, mechanisms linking neuroplasticity to clinical outcomes, and the specificity of effects across mindfulness techniques.

Question	Why
What is the minimum effective dose and duration of mindfulness practice required to induce measurable neuroplastic changes?	Clarifying this will optimize intervention design and accessibility.
How do neuroplastic changes from mindfulness practice translate to long-term behavioral and clinical outcomes?	Linking brain changes to real-world benefits is crucial for clinical application.
Do different mindfulness techniques produce distinct neuroplastic changes, and how do these relate to specific outcomes?	Understanding specificity will enable personalized and targeted interventions.

FIGURE Key open questions for advancing research on mindfulness and neuroplasticity.

In summary, mindfulness practice increases neuroplasticity, but the field is evolving, and further research is needed to refine, personalize, and maximize its benefits.

These papers were sourced and synthesized using Consensus, an AI-powered search engine for research. Try it at https://consensus.app

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