

# A Systematic Review of the Effects of Meditation on Alzheimer's Disease

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## ABSTRACT

Alzheimer's Disease is a very pressing disease that presents neurodegeneration of those affected, with no foreseeable cure as of yet. While there are many treatments that may reduce the level of neurodegeneration, or treat some of the root causes, a definitive solution to Alzheimer's Disease does not exist. Therefore, its harmful effects must be minimized to the greatest extent possible. As such, this paper reviews the current status quo on Alzheimer's Disease treatment, including possible lifestyle choices that have caused Alzheimer's Disease or could potentially contribute to reducing neurodegeneration. In addition, it also considers meditation as an adjuvant treatment to primary treatments to combat Alzheimer's Disease through cognitive stimulation. By reviewing the current scientific literature of meditation where it stands, the aim is to establish meditation as a clear addition to boost the efficiency of prior Alzheimer's Disease treatments including but not limited to pharmacotherapy, behavioral therapy, and cognitive therapy.

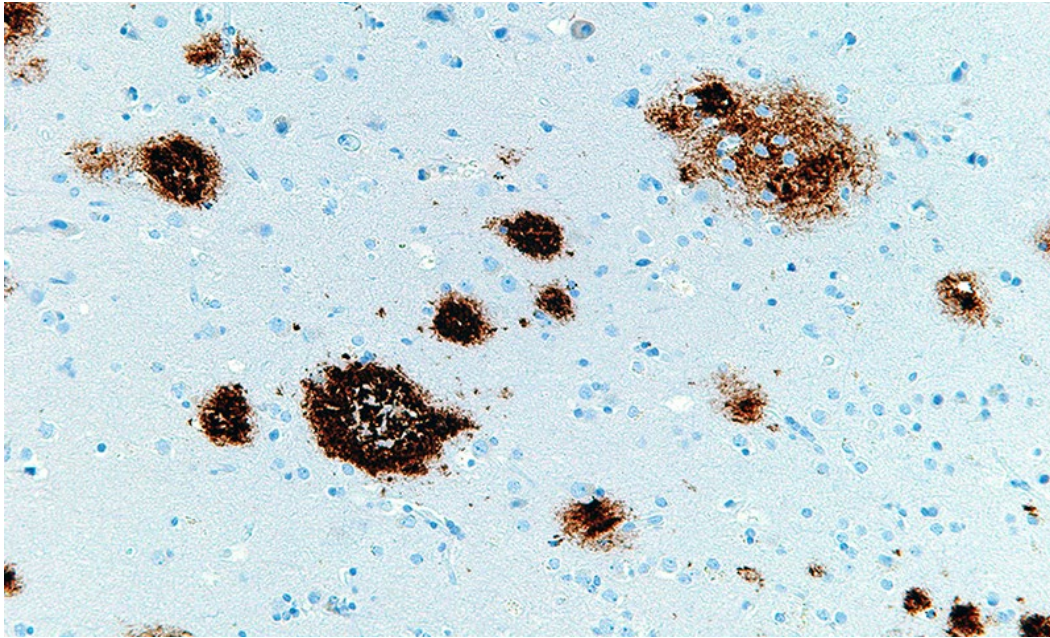
## Introduction

Alzheimer's disease (AD) is a devastating neurodegenerative disorder characterized by cognitive decline, memory impairment, and behavioral disturbances. As the prevalence of AD continues to rise, with over 55 million people affected worldwide (World Health Organization, 2023), there is a pressing need for novel therapeutic interventions to improve the quality of life for affected individuals. One such intervention gaining attention is meditation, a mind-body practice rooted in ancient Eastern traditions. The growing body of research surrounding meditation may serve as a practical complementary approach to alleviate the symptoms of Alzheimer's disease.

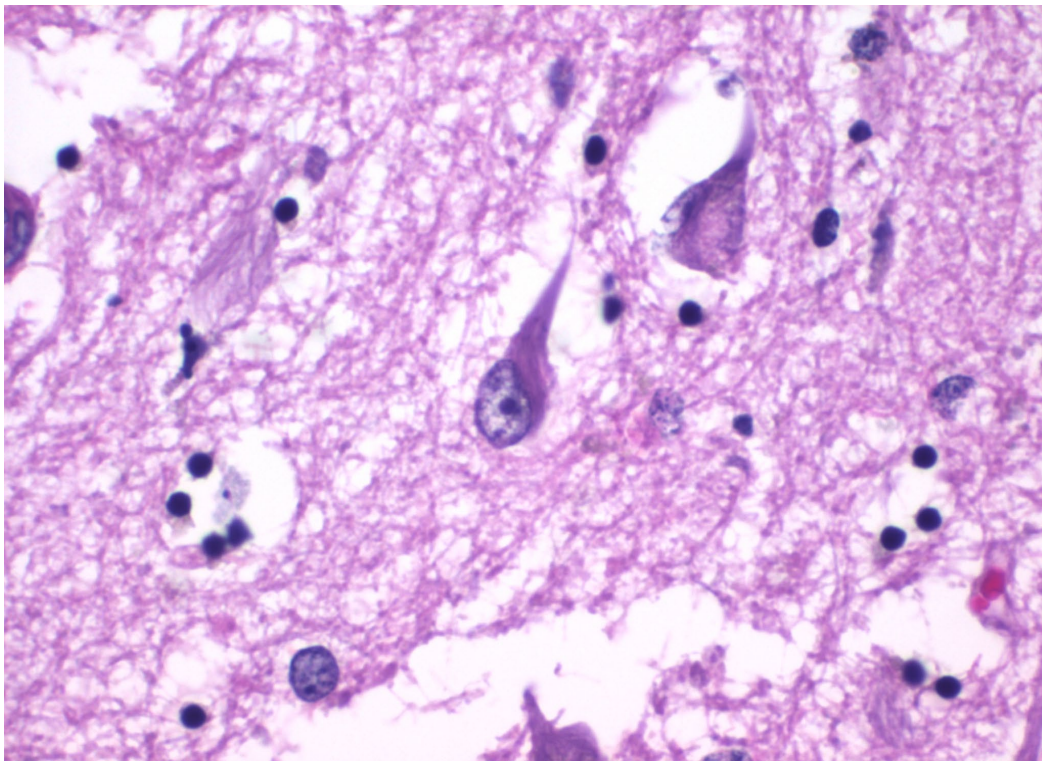
Initially, it should be noted that meditation is not, and should never be considered, a primary treatment; instead, meditation can be an efficient adjuvant therapy that minimizes symptoms and boosts the efficacy of other treatments. Meditation cannot treat Alzheimer's Disease by itself and can only mitigate its symptoms. Therefore, using it to help treatments that prevent Alzheimer's Disease at the root cause is much more beneficial.

## What is Alzheimer's Disease?

Alzheimer's Disease is characterized as a neurodegenerative disorder that slowly destroys cognitive function, most commonly found in individuals usually above their 60s. It is usually characterized as fatal. First discovered by Alois Alzheimer in 1906, Alzheimer's Disease has been studied extensively ever since as the most common form of dementia. The disease's primary indicators, and perhaps causations, are amyloid beta plaques (McGreevey, 2018) and neurofibrillary tangles (Youssef et al., 2016) found in the brain.



**Fig 1.** These brown spots are amyloid beta plaques, located in the cerebral cortex.



**Fig 2.** Neurofibrillary tangles are also indicators of Alzheimer's Disease.

These features are believed to damage various parts of the brain, such as the entorhinal cortex and the hippocampus, which are responsible for functions including memory and computing function. Eventually, other interrelated functions, including but not limited to: language, reasoning, and interactions with other individuals, also decline in function (Chen et al., 2020).

Experience with Alzheimer's is characterized by loss of memories and the ability to execute proper cognitive functions. With the loss of such faculties mentioned above, people cannot execute good judgment and cannot navigate everyday situations properly. In addition to a lack of decision-making, people lose track of dates and other logistics that may be integral, such as location. Most pressingly, they lose a sense of initiative and continuity.

Initially, patients with AD commonly experience inconsistency with newly learned information, often unable to recall parts of all acquired information. Later, symptoms progressively worsen, leading to disorientation, mood and behavior changes, confusion, and worsening relationships with the people around an AD patient (NIA, 2021).

## The Process of Alzheimer's and its Effects

Alzheimer's Disease prevents neurons, or brain cells, from functioning correctly. In the various areas of the brain, as these neurons are unable to work properly and thus cannot communicate or receive information from other parts of the information properly, neurons with loss of function will lead to loss of function in a specific brain area (Alzheimer's Association, 2022). This loss leads to a progressively worsening cycle, as a cascade of adverse effects permeates from one region to another. If one area does not function normally, it often means that another part, which might partially depend on the malfunctioning region, falls as well. Due to the nature of neurons, which require long stages of repair and remodeling attributed to their long lifespan, as well as limited adult neurogenesis, it becomes much more crucial that brain cells survive throughout being an adult. Therefore, even small losses in small regions can eventually have catastrophic consequences for the brain's health as a whole.

On a more mechanical level, the plaques and tangles mentioned earlier are the critical agents in damaging such cells throughout the brain. It should be noted that the amyloid-beta that the plaques are made of are not inherently harmful. In fact, research has implicated that amyloid-beta, to some extent, acts as a protein involved in memory stabilization (Crystal, 2020). In addition, the plaques themselves are not harmful, as most people develop a certain level of amyloid-beta plaques, as well as neurofibrillary tangles. It is when amyloid-beta builds up to an abnormal level, which implicates a high level of plaques, often in key regions of the brain, that Alzheimer's Disease initiates.

On the other hand, the neurofibrillary tangles result from heavy accumulation of tau proteins. Like amyloid-beta, tau proteins are not inherently harmful; instead, they play a role in stabilizing microtubules within neurons, other types of brain cells, and other parts of the brain, including axons and dendrites. In Alzheimer's Disease, tau molecules do not bind to microtubules and attach to each other. The resulting tangles harm communication in the brain and cause numerous other problems.

While understanding the buildup is also a problem, the treatments are equally as important. Research has found that the brain cannot naturally clear away amyloid-beta plaques and tau protein neurofibrillary tangles (NIH, 2017). Therefore, various treatments have been researched, developed, and promoted in order to counteract the insidious symptoms of Alzheimer's Disease.

## Prior Treatments

Currently, a variety of treatments are available for Alzheimer's. None of these can ultimately cure Alzheimer's Disease, but many of them can slow down the symptoms, with some new treatments trying to solve the problem at its potential root by removing the amyloid-beta plaques. The most popular treatments range from pharmacotherapy to various types of cognitive or behavioral therapy.

Furthermore, depending on one's age, medical history, and stage of Alzheimer's, the level of treatment also changes (WebMD, 2023). This variety is due to the potential side effects; depending on the body's disposition, a particular treatment might be better.

One main pharmaceutical treatment is acetylcholinesterase (AChE) inhibitors, which inhibit acetylcholinesterase. These enzymes are responsible for breaking down acetylcholine, which helps communicate between brain cells



(Colovic et al., 2013). Increased communication can be achieved by reducing the amount of acetylcholine broken down, further lessening cognitive impairment is reduced. Commonly prescribed AChE inhibitors are Donepezil, galantamine, and rivastigmine. Research has found that these inhibitors are generally effective in stabilizing cognitive deterioration and reducing mortality (Moreta et al., 2021). However, there was limited efficacy within patients with mild to moderate Alzheimer's Disease, with also little to no behavioral improvements, thus suggesting a potential limitation.

Memantine, an NMDA antagonist, is also considered an alternative to AChE inhibitors by counteracting excessive amounts of glutamate in the brain. Additionally, medications, including antipsychotics like risperidone or antidepressants may be used depending on the specific symptoms of the patient with Alzheimer's Disease.

Aside from medicine, therapy, and other activities are also popular in counteracting Alzheimer's. Cognitive behavioral and stimulation therapy, which involve mental stimulation, can help reduce cognitive degeneration. For example, a study found a 52% clinically significant improvement in reducing depression using engagement with pleasant events (Forstmeier et al., 2015). Participating in these types of cognitive exercises which evoke positive memories and feelings can be an effective way in improving the cognitive and behavioral deterioration of Alzheimer's Disease patients. Moreover, cognitive rehabilitation with a professional or a therapist can help people with Alzheimer's adapt to life with the disease. Exercise and various other mental stimulation activities proved effective in alleviating symptoms (NHS, 2021).

Recently, a new drug, aducanumab, has arisen as a potentially stronger treatment. Despite some controversy that arose from receiving accelerated approval from the Food and Drug Administration, it has been groundbreaking as one of the first treatments to be able to directly remove amyloid-beta plaques directly at the source rather than treating the symptoms retroactively like many of the other drugs or therapies. Being in a nascent stage of development, the potential for this drug seems vast.

## **Meditation: An Alternative Complementary Treatment**

The treatments mentioned above are simply the mainstream, commonly accepted treatments for Alzheimer's Disease. However, a seemingly unlikely practice may serve as an effective counter to Alzheimer's Disease: meditation.

Meditation has been practiced all around the world for millennia, all the way from Europe to Africa to Asia. Throughout its long history, however, it has commonly had stronger documentation within the Eastern tradition (Dharmapala, 1982); nevertheless, this does not exclude any new forms of co-opted, revised, or improved meditation by Western meditative practitioners, and such new scientific findings will also be discussed.

In general, meditation is a practice that cognitively stimulates the brain through various techniques, most commonly relating to mindfulness. Therefore, it cultivates the mind through focus, attentiveness, or overall awareness. This sort of development of the mind would naturally be conducive to combating symptoms of Alzheimer's; such qualities are contrary to the degenerative symptoms of Alzheimer's and would thus counteract them.

Meditation is a practice of concentration that uses physical and mental techniques to clear your mind or focus on a concept or thing. It is used to accomplish many objectives, which include increased concentration, reduced stress, improved critical thinking, and more. Through various types of meditation, including mindfulness meditation, transcendental meditation, body scans, mantra meditations, loving-kindness meditation, and many more, people have discovered that their overall mental well-being has improved drastically throughout their practice.

Previously, meditation was considered a relatively mystic and perhaps more arcane practice done only by those on the fringes of the scientific community and by original practitioners. However, it has become a widespread and prevalent topic increasingly backed by empirical scientific research. Through evidence-based research, meditation has reached a basis of scientific verification, where scientists are able to outline precisely what meditation makes it effective.

## The Science of Meditation

In essence, researchers have primarily found evidence in neuroscience, psychology, and physiology, to name a few. Changes observed in these areas, as well as many others, have primarily demonstrated meditation to cause a noticeably positive effect on mental and bodily health. While scientific literature may not be able to define the exact mechanical procedures concretely, it has established strong correlations.

Research shows that meditation causes changes to brain structure and produces levels of brain activity usually associated with positive mental stimulation (Moore & Washington, 2021). Specifically, some key regions are affected more than others. For example, the prefrontal cortex, which is responsible for decision-making and various other cognitive functions such as emotional regulation and attention, has increased neuroplasticity and neural stimulation due to meditation. Long-term meditation practices can potentially lead to size changes in the brain (Lazar et al., 2005). Meditation is also associated with decreased activity in the default mode network, or DMN, which is responsible for mind-wandering; as a result, the mind is considered to be more aware of its thoughts and is more stabilized in its activity. Next, studies found decreases in activity or volume of the amygdala, which is responsible for stress-related emotions such as fear and anxiety. Meditation plays a part in regulating these emotions, stabilizing an individual's feelings, and creating a calmer sense of mind.

Aside from brain structure itself, meditation may also affect brain waves, some of which are associated with certain types of brain activities (Meda, 2019). In fact, meditation research has revealed that meditation can potentially reduce beta waves – which are responsible for active thought – and increase alpha waves, which are responsible for relaxation. Thus, meditation is able to create a sense of calm and peace on one hand, in addition to cultivating a greater understanding of critical thinking in other areas.

Even beyond purely mental, neurological, or psychological effects, meditation can even affect the body itself. Meditation is linked to lower blood pressure, stronger immune systems, and reduced risk of various health complications, including heart disease and chronic pain (Mayo Clinic Staff, 2022). Moreover, while reducing negative bodily effects, it can also enhance positive ones. For athletes, meditation can be a great and effective way to boost performance through body awareness, improved exercise, and reduced pain.

## Meditation and Alzheimer's

With the establishment of Alzheimer's as a dangerous neurodegenerative disease and meditation as a cognitively stimulating practice, the applications of meditation within the realm of Alzheimer's Disease treatment arise. As the scientific practice of meditation only recently arose, practical applications of meditation within specific medicine or therapy-based areas remain even more tentative as of the current era.

Nevertheless, the very nature of meditation does pose a very convincing method to contribute to the process of mitigating neurodegenerative diseases such as Alzheimer's Disease.

Thus, in mitigating Alzheimer's Disease, attempting to minimize its neurodegenerative effects for as much as possible and as long as possible remains crucial in treating the disease because no definitive cure exists. Aducanumab remains one of the most prominent pharmacotherapeutic treatments in contributing towards a definitive cure, but it is still unable to prevent the progression of Alzheimer's Disease decisively. Attempts to reduce the harmful effects of Alzheimer's Disease must be optimized in terms of resource allocation and efficiency, essentially to slow down the headway of Alzheimer's Disease; in other words, individuals with the disease should maximize their decisions down to lifestyle choices up to crucial treatments to fight against Alzheimer's Disease.

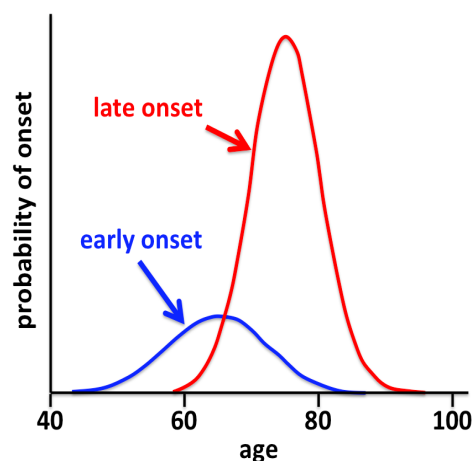
## Meditation as a Lifestyle Choice

Already several established healthy lifestyle choices are recommended by health experts to fight against the onset of Alzheimer’s Disease symptoms, most prominently the ones affecting cognition (Centers for Disease Control and Prevention, 2022). These lifestyle choices are designed to help people reduce Alzheimer’s Disease symptoms as many of them are inherently cognitively stimulating or simply healthy for the body, boosting the body’s systems and overall well-being. Many of these lifestyle choices combat poor ones, measured in risk factors: high blood pressure, lack of proper physical activity, being overweight or obese, having diabetes, depression, or hearing loss, and practicing unhealthy habits such as smoking or binge drinking. These risk factors are often interrelated. Thus, practicing even one of many healthy lifestyle choices may cut out or mitigate more than one of these risk factors.

Preventing high blood pressure includes getting enough sleep, limiting the alcohol one drinks, not smoking, and being physically fit or active (CDC, 2020). These habits prevent the body from getting used to being damaged by harmful substances such as alcohol or those found in cigarettes. Lowering weight has also been shown to correlate to lower blood pressure via reduced cardiac workload (Cohen, 2017). In addition, correcting hearing loss and managing blood sugar to prevent diabetes also play a part in reducing the effects of Alzheimer’s Disease.

If incorporated into a patient’s life, these lifestyle choices significantly reduce the burden of Alzheimer’s Disease. Similarly, if meditation is made a daily staple of life for a person with Alzheimer’s Disease, the cognitively stimulating effects of meditation could greatly aid in reducing the detriments of Alzheimer’s Disease. Meditating daily would mean actively stimulating the brain in ways that slow the progress of Alzheimer’s Disease, in addition to causing various other beneficial psychosocial effects.

The first and most prominent benefit of meditation is the slowing of aging. Alzheimer’s Disease is closely associated with the age of the patient. Symptoms typically appear first in people’s mid-60s (sometimes even as early as their 30s, although this is considered rare) (NIH, 2022). While age itself is not a direct cause of Alzheimer’s Disease, it does provide a strong indicator of the potency and dangerousness of the disease; in general, older age is correlated with more severe Alzheimer’s (NIH, 2019).



**Fig 3.** Alzheimer’s levels generally increase as age increases.

However, research shows that meditation slows the aging of the brain. A study discovered that while gray matter decreases as a person ages, for long-term meditators, researchers discovered higher amounts of gray matter in their brains, suggesting a reduction of neurodegeneration (Cohen, 2015), with meditators’ brains generally being healthier and less aged comparatively (Dwivedi et al., 2021). Therefore, as one of the primary indicators of Alzheimer’s Disease risk appears to be reduced by meditation, the practice does have a baseline of effectiveness.

Second, meditation also mitigates the reduction of the hippocampus (Luders et al., 2015). The damage or reduction to the hippocampus and related structures from Alzheimer's Disease results in higher difficulties in internalizing or effectively forming new information or memories (Surendranathan & McKiernan, 2019). However, practitioners of meditation found larger structural hippocampal sizes in comparison to those who do not practice meditation regularly (Powell, 2018).

Aside from direct structural changes to the brain, meditation is associated with other types of genetic and chemical changes, including increased stimulation of specific genes relevant to reduction of neurodegenerative effects. A study discovered that when participants meditated using any technique of their choosing, insulin pathway genes experienced increased upregulation, as insulin resistance had been shown to be a potential risk factor. Moreover, other positive aspects of the body's biological systems including stronger metabolisms and mitochondria function had also been demonstrated.

Telomerase, an important enzyme in the reduction of aging, was also increased through meditation. Telomerase counteracts the shortening of telomeres in DNA, thus reducing the process of aging which is partially caused by the shortening of such telomeres. As meditation was able to increase telomerase, it can be correlated with a slowing of aging (Khalsa, 2015).

Meditation in the realm of neuroscience has a growing body of scientific evidence to support its results; in addition to such empirical data, meditation can cause general trends of positive behavior and thinking within patients affected by Alzheimer's.

This is because meditation – particularly mindfulness meditation – encourages individuals to focus on the present moment and their internal experiences. This practice has been shown to reduce rumination about past events and worries about the future, which are common triggers of loneliness. Engaging in meditation can foster a sense of self-awareness and self-compassion, thereby alleviating feelings of isolation (Saini et al., 2021). Moreover, meditation groups provide a social context for Alzheimer's patients to connect with others who share similar experiences, potentially reducing social isolation.

As such loneliness is reduced, a positive mindset and view comes naturally. Alzheimer's patients often struggle with mood disturbances and negative emotions, but meditation promotes positive emotions by increasing awareness of positive stimuli in the environment and developing an attitude of non-judgmental acceptance toward thoughts and feelings. This shift in mindset can contribute to improved emotional well-being, leading to a more positive outlook on life despite the challenges posed by the disease.

Finally, as cognitive decline progresses in Alzheimer's disease, maintaining a balance between logic and emotion becomes crucial (Lardone et al., 2018). Meditation practices emphasize mindfulness and awareness of thoughts without immediate judgment. This can help individuals separate their emotional responses from cognitive processes, fostering logical thinking and decision-making while reducing emotional reactivity.

## Conclusion

While meditation has been an age-old practice used by individuals around the world for millennia, the recent scientific literature on it has made it a much more prevalent practice even for non-religious people, as its scientific basis has been clearly demonstrated through countless studies and reviews. The evidence and discourse presented in this review paper discusses Alzheimer's Disease as of now, with its current treatments and potential horizons. Furthermore, by also emphasizing the benefits of meditation especially relevant to cognitive stimulation, it can be demonstrated how it can be used as an adjuvant treatment in order to synergize with other primary treatments of Alzheimer's Disease and reduce cognitive neurodegeneration.

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