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COMMENTARY

# Links Between Supplements and Alzheimer's Disease

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## Introduction

The brain of someone with Alzheimer's disease (AD) was first observed and identified in 1906 by German psychiatrist Alois Alzheimer. He arranged an autopsy of patient Auguste D's brain and found alterations that we know today as protein plaques and neurofibrillary tangles [1]. In a similar case, 5 years later, Josef F. reported symptoms similar to Auguste, and he was diagnosed with AD. At the time of Josef's death, Alzheimer discovered that Josef had protein plaque, but his brain lacked the neurofibrillary tangles that were found in Auguste's autopsy and it was disputed amongst psychiatrists whether or not this was the same disease [2]. In a study done with the autopsies of Josef and Auguste, it was found that Auguste simply had a later stage AD than Josef [2]. Alzheimer was a pioneer in introducing "presenile dementia" as a new disease caused by the degeneration of the brain because of the buildup of proteins accompanied by tangles of neurons. Today, we still have no known cure for AD, but there are many vitamins and dietary choices that have been rumored to prevent or even reverse AD.

This commentary will review different studies and research papers done to prove or discredit the benefits of vitamins and whether or not vitamins can reverse or prevent AD. We will examine to what extent vitamins or diets can affect the outcome of someone suffering from AD and conclude whether or not supplements prove to benefit people with Alzheimer's Disease.

## Understanding the Human Brain

The brain is the key that unlocks our consciousness, it is the doorway to understanding the essence of life, and it is the leader of our body's nervous system.

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Though it may weigh less than half of a gallon of milk, the brain is an enigma, being the most complex part of the human anatomy. The most basic principle is that the brain is the command center of any sentient being.

The brain contains 4 regions: the cerebrum, cerebellum, diencephalon, and brain stem [3]. Each region has a crucial role in the function of our anatomy. The cerebrum itself is made of the frontal, temporal, parietal, and occipital lobes. The frontal lobe is necessary for many functions that require high amounts of cognition such as thinking, voluntary movement, speaking, and planning [3]. The parietal lobe functions to receive and process most sensory information and understand language [3]. The temporal lobe is responsible for hearing, object recognition, and the formation of visual memories [3]. The occipital lobe focuses mainly on vision, aiding in determining color, distance, and visual perception [3]. The cerebellum mainly controls coordination, balance, and maintenance of posture [4]. The diencephalon, the often-forgotten portion of the brain due to its medial location, helps process and relay sensory information, and it aids with autonomic control [5]. The brain stem is responsible for breathing, temperature, and heart rate [4].

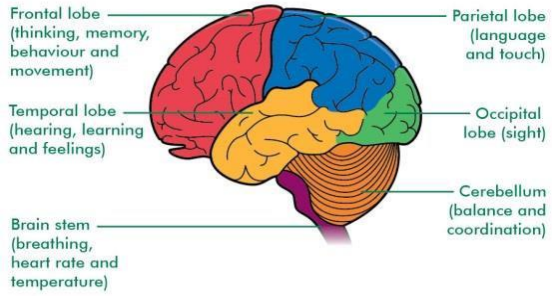


Figure 1

The brain executes these functions by dispatching messages across the body via its central and peripheral nervous systems. The central nervous system contains the brain and spinal cord whereas the peripheral nervous system consists of the autonomic and somatic nervous systems. The somatic nervous system controls voluntary actions. On the other hand, the autonomic nervous system is in charge of involuntary functions [6].

While the brain may consist of many different regions and sub regions, all of these parts work together efficiently and effectively to carry out the body's functions. Any disruptions to this fragile system can cause harmful effects. AD is an extraordinary example of the previous statement.

## Pathophysiology of Alzheimer's

Alzheimer's disease is a growing problem in American society. About 5 million Americans see the effects of AD, this estimate will likely triple to 14 million, by the year 2060 [7]. AD is a dynamic, gradual progressive mental deterioration that commonly occurs in old age, and it is the leading cause of dementia [8]. It is caused by the buildup of protein that degenerates neurons in the entorhinal cortex and hippocampus, which is the connection to the memory part of the brain. It will then affect the cerebral cortex which is responsible for much of our language, reasoning, and social behavior. β-amyloid and tau are the proteins that do the degeneration. Amyloid builds up and creates plaque around and between the cells, which will disrupt cell function. Tau is the protein that assists in the generation of microtubules. These microtubules are essential in transporting nutrients, and the excess tau will begin to tangle and restricts nutrients from being transported [8].

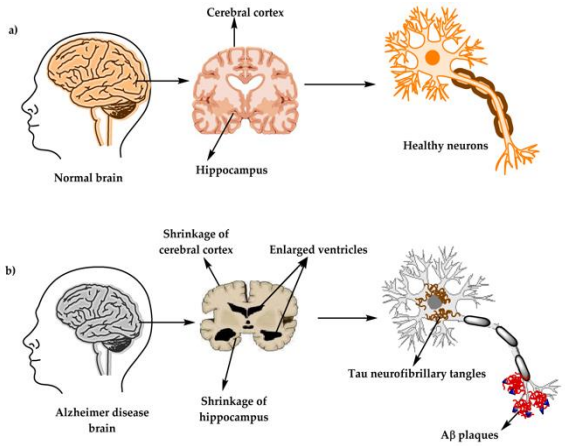


Figure 2

These slight changes in the nervous system are enough to cause many problems, proving just how fragile our nervous system is. Although it may not be a sure fix, staying informed of the risk factors and the accrual of a sufficient number of beneficial vitamins

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may assist in the prevention of AD. The possible risk factors include genetics, head injuries, vascular disease, infections, environmental factors, and lifestyle [8]. In theory, if plaque can be prevented from forming and the tau from tangling, there will be an effective prevention of AD by addressing the problem at its root.

## How vitamins affect neurodegeneration

It is believed that the degeneration of the brain can be prevented with vitamins that include beneficial supplements to the brain. The common over-the-counter vitamins bought include Omega-3, Vitamin D, B12, and folic acid, which are widely disputed to reduce the probability of Dementia and reduce cognitive decline in the early stage of AD [9]. Based on the available data, it is believed that deficiencies in vitamins may affect the brain and increase your risk of having AD [10]. For example, having a deficiency in vitamin D has shown to increase your chances of developing AD, and low levels of vitamin B are associated with high levels of amyloid in the brain [10,11]. It has been proposed that many other vitamins can have a great effect on one's health particularly when it comes to AD.

## Specific vitamins and their effects on the treatment of Alzheimer's disease

### *Omega 3 Fatty Acids*

Since a low level of DHA, a type of omega 3 fatty acid, in the hippocampus and frontal cortex is usually detected in AD patients, a diet that includes a higher intake of Omega 3 with DHA can improve the symptoms of AD [12]. Although there hasn't been concrete evidence that Omega 3 can effectively eradicate Alzheimer's, when taken long before symptoms arise, can be used as prevention and even help ease symptoms when they are mild [12]. Foods rich with Omega 3 include salad dressing, nuts, fish, tomatoes, poultry, cruciferous vegetables, fruits, dark and green leafy vegetables [13].

### *Axona (caprylic acid)*

Axona, also known as caprylidene, is a medical food and supplement that has caprylic acid as its active ingredient. It is a medium-chain triglyceride that serves as an energy source for brain cells that have lost their ability to produce glucose. In the case of an AD patient, it can replace the role of glucose. Although it hasn't been approved by the FDA and is not recommended by the Alzheimer's Association, it has been observed through a small study that there was a slight improvement in cognitive function and memory in patients with moderate and mild forms of AD [14].

### *Vitamin D*

Vitamin D is a nutrient humans need that comes mainly from sun exposure, over-the-counter supplements, and foods rich in this mineral (Cod liver oil, Salmon, Tuna fish, orange juice fortified, Sardines, Beef liver). A meta-analysis conducted by a group of researchers at Neurology concluded that patients with AD had a lower presence of vitamin D than the control group of seemingly healthy individuals [15]. Results from a similar meta-analysis suggested that subjects deficient in vitamin D produced an increased risk of developing AD by 21% more than those with higher levels of the supplement [16]. Although it is observational, these studies pave the way for future trials that further prove whether vitamin D can successfully delay and prevent the onset of AD/dementia in geriatric individuals [17].

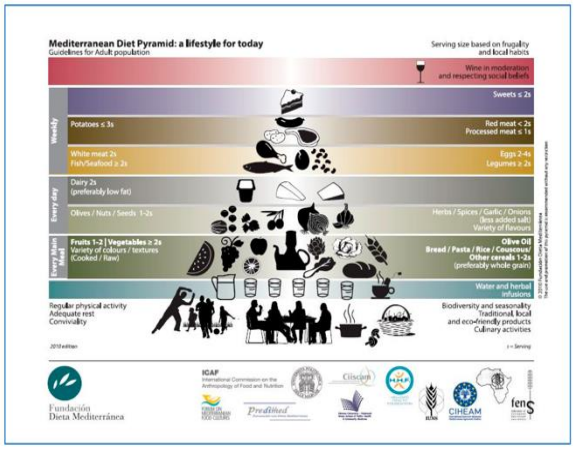


Figure 3

### *Vitamin B12 and Vitamin B9*

Vitamin B9, also known as folate or folic acid, is a supplement that aids in the development of the central nervous system. Although it is highly regarded as a symptom reliever for AD patients, there is insufficient evidence that the combination of vitamins

B9 and B12 or either one alone can combat cognitive decline as no adverse or beneficial effects were concluded since patients did not experience a change [18, 19].

## The Mediterranean diet, a diet that combats Alzheimer's

While buying vitamins at your local supermarket is easily accessible, there are diets constructed carefully to improve mental and physical health. For example, in Greece, the Mediterranean diet is based on fish, olive oil, nuts, and the careful consumption of wine [20].

This diet supplies the consumer with monosaturated fats, Omega-3s, and antioxidants [21]. Not only does a Mediterranean diet give our brain DHA [22] and antioxidants that protect neurons from oxidant stress damage [23], but its containment of monosaturated fats can also decrease your risk of cardiovascular disease [24]. Although buying vitamins over the counter may be beneficial, there are plenty of dietary options that provide the nutrients and vitamins our brain needs to avoid, prevent, or stall out the effects of AD and neurodegeneration.

## Conclusion

Alzheimer's disease is a serious problem facing the United States today. It is important to know what may help prevent or ease the effects of Alzheimer's Disease. It is also important to know the effects, if any, of the different supplements discussed.

We can conclude that folate and B12 with folic acid do not have any link to AD. Although in the cases of omega 3s and vitamin D, it is shown that low levels of each are detected in AD patients. While these supplements may not be cures or foolproof prevention for Alzheimer's, the fact that low levels of each are prevalent in patients with AD is enough to suggest a sufficient amount of each is in your body at any given time. Axona has been shown to express slight improvement in cognitive function and memory in patients with a moderate and mild form of AD. An alternative route of reaping the benefits of these supplements is modifying your dietary plan. If you use your diet to your advantage, you are able to consume beneficial vitamins and minerals that have been proven to slow the progression of AD.

Clinical research still needs to be conducted to investigate additional supplements and to discover any other variables that may affect the development of AD. Clinical research should not be something to fear because its main goal is to benefit society. The stigma around clinical research should be broken down to normalize clinical research. This will cause people to willingly participate, and this will help increase our knowledge of the world around us. It is also important to take action in your community by speaking on Alzheimer's Disease and educating yourself and others about clinical research, including why it's safe and beneficial. Together, we can work to find out more about Alzheimer's disease and work toward a cure.

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