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# Can eating nuts reduce the risk of dementia?- narrative review

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**Abstract**

**Introduction**: Dementia is a growing health problem in aging societies, and its prevention is one of the most important challenges of modern medicine. In recent years, there has been growing interest in the role of diet in reducing the risk of developing dementia, including the consumption of nuts, which are a rich source of nutrients with potential neuroprotective properties.

**Aim of the Study:** The aim of this study is to review the available research on the effect of nut intake on the risk of developing dementia and to analyze the biological mechanisms that may explain this association.

**Materials and Methods:** A review of available studies on the association between nut consumption and dementia risk was conducted. Data were collected from a variety of cohort and clinical studies that included people of different ages, most often the elderly, and monitored their diet and cognitive function. The analyses included different types of nuts, such as walnuts, almonds, and Brazil nuts.

**Results**: Available research suggests that regular consumption of nuts may benefit cognitive function and reduce the risk of dementia. Mechanisms of potential action include antioxidant properties, anti-inflammatory properties and what may indirectly protect the brain from degeneration. Despite promising results, not all studies show unequivocal benefits, which may be due to differences in study populations, methodology and the type of nuts consumed.

**Conclusion**: Nut consumption may be one component of dementia prevention, but further research is needed to better understand the mechanisms of action and to determine the optimal amounts and types of nuts.

**Keywords**: nuts, dementia, cognitive function, prevention, diet, neuroprotection

## Introduction

Worldwide, dementia affects more than 55 million individuals, more than 60% of whom live in middle- and low-income countries. Nearly 10 million new diagnoses are reported each year. Dementia currently ranks as the seventh most common cause of death and is one of the leading causes of disability and loss of independence among the world's elderly (WHO, 2023). In 2019, the total annual social cost of dementia worldwide was $1313.4 billion for the 55.2 million individuals affected, averaging of $23,796 per person. Of this total, $213.2 billion (16%) came from medical expenses, $448.7 billion (34%) were social sector costs, including long-term care, and $651.4 billion (50%) were informal care costs (Wimo et al. 2019).

As a result of increasing life expectancy, healthy aging and improved quality of life are becoming increasingly important for older people (Johannesson et al.1997). Quality of life for seniors is complex and depends on many factors, including personal factors such as satisfaction with one's physical and mental health (García,et al.2018). Studies have shown that telomere length is an important indicator of the aging process (Sanders, et al. 2013), while maintaining optimal physical and cognitive function enables older adults to live independently for a long time. The World Health Organization has made healthy aging a priority, developing policies to support the well-being of older adults and their independent living (Rudnicka, et al.2020). Well-being and adequate nutrition are key to health, autonomy and quality of life, especially for the elderly. It is estimated that at least half of seniors who do not live in nursing facilities need nutritional intervention to improve their health. In addition, 85% of them are struggling with one or more chronic diseases, the symptoms of which can be alleviated with the right diet (Hamirudin et al. 2016).

One often underestimated product whose consumption is associated with numerous health-promoting benefits is nuts. They are an important part of the primarily Mediterranean diet and are recommended for consumption in many populations around the world (Ross et al., 2014). They contain healthy monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acid

profiles, protein, both soluble and insoluble fiber, vitamins E and K, folic acid, thiamine, minerals such as magnesium, copper, potassium and selenium, and substances such as xanthophyll carotenoids, antioxidants and phytosterols, which have proven positive effects on human health (Cardoso et al. 2017, Tas et al. 2017, Souza et al. 2015).

People who eat nuts have a better quality diet compared to those who do not eat them (Brown et al. 2016, O'Neil et al. 2015). The high content of unsaturated fatty acids, the low ratio of lysine to arginine and the presence of other bioactives make the inclusion of nuts in a healthy diet an effective tool in the prevention of cardiovascular disease (Bitok et al. 2018, Brufau et al., 2006).

Increased consumption of nuts, including tree nuts, is associated with a lower risk of cancer development and lower cancer mortality. (Naghshi,et al. 2020). Although nuts are a caloric and fatty food, they are not a major energy problem, and may even help control body weight (Akhlaghi et al. 2018, Tan et al. 2014). Eating nuts can improve insulin sensitivity, which in turn can delay the development and progression of type 2 diabetes (Kim et al. 2019, Tindall et al. 2019).

A popular snack from this product group is pistachios. They stand out for their richness in nutrients and bioactive compounds that can affect health. In particular, phenolic compounds in pistachios have antioxidant and anti-inflammatory effects. Pistachio consumption can support cognitive function, modulate the gut microbiota, and positively affect skin and retinal health. In addition, pistachio polyphenols can affect glucose-regulating enzymes, which is important in the context of type 2 diabetes, and have shown antimicrobial and antiviral potential (Mandalari et al. 2022).

The purpose of this review is to analyze the effect of nut consumption, both alone and as part of an overall dietary plan, on reducing the risk of dementia. We hypothesize that nuts may help improve the quality of life of older adults by promoting better health, cognitive function and the ability to function independently.

**Clinical Evidence**

The link between the effects of nut consumption on dementia risk has been studied in several papers. One of the most recent studies by Bizzozero-Peroni and colleagues (2023) used data from the UK Biobank cohort to examine the association between nut consumption and dementia risk in adults. Baseline data on nut consumption were collected using the Oxford WebQ 24-hour questionnaire. A total of 50,386 participants (mean age 56.5 ± 7.7 years, 49.2% women) were included in the prospective analyses. The prevalence of dementia was

2.8% (n = 1,422 cases) due to various causes. Compared to no nut consumption, daily nut consumption (> 0 to 3 or more handfuls) was associated with a 12% lower risk of developing dementia (risk ratio = 0.88; 95% confidence interval: 0.77-0.99) after 7.1 years of follow-up, after accounting for potential confounders. No statistically significant interactions were observed between nut consumption and any of the interdependent variables included in the regression analyses. In contrast, stratified analyses indicated that the greatest protective benefits were associated with consumption of up to one handful of nuts (30 g/day) and with the choice of unsalted nuts. Regular consumption of nuts may play a protective role in the prevention of dementia.

A cross-sectional study was conducted among 39 patients from Yucatán, Mexico, as a control group and 34 individuals with cases of MCI and dementia. Using a food frequency questionnaire, data were collected on diet, anthropometric and clinical parameters, and lifestyle characteristics. Nuts and seeds were a characteristic part of the dietary pattern of elderly people without cognitive impairment. In the control group, a positive correlation was observed between the consumption of “nuts and seeds” (r = 0.333, p = 0.01). Including an adequate amount of nuts in the diet can improve the quality of life of people suffering from cognitive impairment (Garrido-Dzib, et al.2024)

In a prospective evaluation study, 119 representatives of an elderly Italian population were observed. Nut intake was assessed at the beginning of the study using a validated questionnaire on frequency of consumption or using the HPLC-Q-ToF-MS metabolomic approach. Exposure to nuts in the diet is associated with urinary polyphenol metabolites and fatty acid pathways. Nut consumption, as assessed by the dietary or urinary marker model, is associated with less cognitive decline in both (OR: 0.78, 95% CI: 0.61, 0.99; p = 0.043 and OR: 0.995, 95% CI: 0.991, 0.999; p = 0.016, respectively) with AUCs of 73.2 (95% CI: 62.9, 83.6) and 73.1 (62.5, 83.7). Thus, it has been demonstrated that high nut intake may be protective against cognitive decline in the elderly. Metabolomics offers precise information on nut exposure, reinforcing the results obtained from dietary data (Rabassa,et al.2020).

Other studies also provide important evidence of the benefits of nuts. For example, a study conducted by Li and colleagues (2019) in China between 1991 and 2006, included 4822 adults aged 55 and older. Nut intake was assessed using a 3-day dietary reminder, as well as through questionnaires on cognitive function. Results indicated that nut consumption of more than 10 g/d was associated with a higher cognitive function score of 0.63 points (95% CI 0.15-1.12) and a 40% lower risk of impaired cognitive function (OR 0.60, 95% CI 0.43-0.84),

after accounting for factors including demographics, lifestyle, habits, body mass index (BMI) and energy intake.

A study by Arab and colleagues (2014) was conducted to examine the effects of walnut consumption on cognitive function among US adults. They used data from two rounds of the National Health and Nutrition Examination Survey (NHANES) from 1988-1994 and 1999-2002, covering adults aged 20-90 years. Nut intake was assessed by 24-hour dietary interviews, and cognitive function was measured by tests such as the SRTT, SDST, SDLT, SRT and DSST. Those aged 20-59 consuming an average of 10.3 grams of walnuts per day performed better on cognitive tests, including shorter reaction times on the SRTT (16.4 ms, P=0.03) and SDST (0.39 s, P=0.01). Older adults (60+) consuming an average of 13.1 grams of nuts per day showed higher scores in SRTT (by 7.1 percentage points, P=0.03) and DSST (by 7.3 percentage points, P=0.05). Trend analyses confirmed a significant association between higher nut consumption and better performance on cognitive tests.

The Walnuts And Healthy Aging study was designed to assess the effects of two years of dietary walnut supplementation on cognitive function in healthy older adults. It was conducted at two centers (Barcelona, Spain; Loma Linda, California) with 708 participants aged 63-79, 68% of whom were women. Participants were randomly assigned to a diet group enriched with walnuts (30-60 g/d, ~15% of energy) or a control group without nuts. Comprehensive neurocognitive tests were conducted at the beginning of the study and after two years. Analysis of the modified ITT set showed no significant differences between groups in the global composite cognitive score (mean change: -0.072 [95% CI: -0.100, -0.043] in the nut group vs. -0.086 [95% CI: -0.115, -0.057] in the control group, P = 0.491). However, post hoc analyses revealed significant differences in the Barcelona cohort. In this group, unadjusted changes were -0.037 (95% CI: -0.077, 0.002) in the walnuts group and -0.097 (95% CI: -0.137, -0.057) in the control group (P = 0.040). Barcelona fMRI results indicated greater functional network recruitment during working memory tasks in the control group. In addition, participants from Barcelona differed from those from Loma Linda in terms of education level (lower in Barcelona), cigarette smoking (more frequent in Barcelona), and baseline scores on neuropsychological tests (lower in Barcelona).Walnut supplementation was well tolerated and adhered to. The results suggest that a walnut-enriched diet may delay cognitive decline in higher-risk populations, but the lack of conclusive effects in the overall analysis justifies the need for further research in this area (Sala-Vila, et al.2020).

A study by Coates and colleagues (2020) examined the addition of almonds to the standard diet as one source of energy. A total of 363 participants were examined, of whom 128 completed the study. No significant changes were observed in any of the individual cognitive performance test measures or in the total cognitive function score. Only in one group was a trend toward improved alertness noted, but no differences were found in other mood measures ($p < 0.05$).

On the other hand, a study by Cardoso and colleagues (2015) in which the diet was supplemented with one Brazil nuts (~5 grams) per day for 6 months showed improvements in two (verbal fluency and construction skills) of the six subsets of neuropsychological tests developed by the Consortium for the Establishment of an Alzheimer's Disease Registry (CERAD). The study enrolled 31 older adults with mild cognitive problems. Only the change in GPx activity in erythrocytes showed significant differences between the groups among parameters related to the antioxidant system ($p = 0.006$). After 6 months, the supplemented group showed significantly greater improvements in verbal fluency ($p = 0.007$) and construction skills ($p = 0.031$) compared to the control group.

There are also studies that included nuts as part of an overall Mediterranean diet intervention, in addition to those that focused directly on nuts. A study by Bottereo and colleagues (2020) identified genes that may be associated with the positive effects of the Mediterranean diet. Previously, a similar methodology was used, to understand the mechanisms associated with Parkinson's disease, Alzheimer's disease and other forms of dementia. The diet-related genes identified showed that NFIL3, the nuclear factor interleukin 3, was downregulated after taking all three of the olives, nuts and long-chain omega-3 fatty acids. In addition, levels of interleukin 8 (IL8), serine/threonine kinase 17b (STK17B), serpin family member B 2 (SERPINB2) and regulator of G protein signaling 1 (RGS1) were observed to decrease after the inclusion of the two supplements in the diet. An interesting observation was that some of the transcription factors that were downregulated when nuts were introduced into the diet, among other things, are common to processes associated with dementia, suggesting that these foods may also help lower the risk of dementia and other cognitive impairments.

The study was conducted to examine the relationship between adherence to a Mediterranean diet (MD) and cognitive function among Italian seniors from an urban population. A total of 279 participants aged 65 and older (199 women and 80 men) took part. MD adherence was assessed using a 14-item questionnaire, and cognitive function was assessed using the MMSE test. It was found that 30.1% of participants adhered to the MD pattern, while 13.6% had

suspected mild cognitive impairment (MMSE score ≤ 23). MD adherence was shown to reduce the risk of cognitive impairment (OR = 0.39; p = 0.045). Consumption of wine (OR = 0.37; p = 0.018) and nuts (OR = 0.30; p = 0.005) had a similar effect. Other product groups showed no significant relationship with cognitive function. Consuming nuts may further support brain health. The study highlights the benefits of a well-balanced diet in the prevention of cognitive impairmen (De Amicis et al. 2018).

A study by Thomas and colleagues (2022) examines the relationship between adherence to the Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet, tailored to French dietary habits, and dementia risk. The MIND diet, which emphasizes consumption of vegetables, berries, whole grains, olive oil, fish, beans and poultry in addition to nuts, while limiting meat, sugars and saturated fats, is considered a promising strategy for preventing dementia. The study involved 1,412 participants aged 65 and older, observed for nearly 10 years. The results showed that higher adherence to the MIND diet was associated with a lower risk of developing dementia and Alzheimer's disease (risk ratios for 1 score point = 0.89 [95% confidence interval, 0.83-0.95] and 0.88 [0.81-0.96], respectively). In addition, MRI analysis indicated that a higher MIND diet score was associated with better white matter microstructure (P <.05 after Family-Wise error correction), suggesting that diet may play a protective role in maintaining brain health. These findings support the growing evidence of the benefits of appropriate dietary patterns, including nut consumption, in reducing the risk of dementia.

**Conclusion**

Conclusions from a review of studies on the effects of nut consumption on dementia risk indicate the potential benefits of regularly including nuts in the diet. Most studies show that nut consumption is associated with a lower risk of developing dementia and improved cognitive function, particularly in older populations at risk of mental decline. Studies such as the one by Bizzozero-Peroni and colleagues (2023) and Rabassa and colleagues (2020) have shown that regular consumption of nuts, particularly walnuts, can reduce the risk of dementia, as well as promote the preservation of cognitive performance.

The findings indicate that nut consumption, even in small amounts, can have a positive impact on brain health, reducing the risk of cognitive decline. In studies conducted in various parts of the world, including China, Italy, and the United States, positive correlations were observed between nut consumption and cognitive test scores. It should also be noted that the most favorable effects occur when nuts are consumed in their unsalted form, which may be due to

their beneficial effects on inflammation and heart health, both of which are linked to cognitive function.

Despite the promising results of many studies, not all of them provide clear conclusions. For example, the study by Sala-Vila and colleagues (2020), while showing some benefit in delaying cognitive decline in high-risk groups, does not show significant improvement in overall analyses. Further research is therefore needed to better understand the mechanisms by which nuts may affect brain health, and to determine the optimal doses and types of nuts for dementia prevention.

It is also worth noting that some studies, such as the one by Coates and colleagues (2020), found no significant differences in cognitive function scores after consuming almonds, suggesting that not all types of nuts have the same effect on brain health. This may be due to differences in the nutritional composition of different types of nuts, as well as individual factors such as genotype, lifestyle or other dietary habits.

In conclusion, although there is growing evidence that nut consumption may have a protective effect on cognitive function and reduce the risk of dementia, further research is needed to precisely determine the mechanisms of these effects. Certainly, however, nuts are a valuable part of a healthy diet that can support brain health, especially in older age. Including them in the daily menu, alongside other healthy eating habits such as the Mediterranean diet, may be an effective strategy for dementia prevention.

**Authors' Contributions:**

Conceptualization was done by Ewa Malaka and Martyna Byrska; methodology by Marlena Zubiak software by Hanna Barska-Kobylińska; checking by Sara Langner, Marta Janura Hanna Barska-Kobylińska; formal analysis by Marta Janura and Sara Langner; investigation by Hanna Barska-Kobylińska; resources by Martyna Byrska; data curation by Marlena Zubiak; writing - rough preparation by Marta Janura; writing - review and editing by Sara Langner, Ewa Malaka; visualization by Martyna Byrska; supervision by Marlena Zubiak; project administration by Marta Janura and receiving funding by Sara Langer.

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