Vegan Diet and Alzheimer's Disease Prevention: Risk or Benefit?

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Key highlights:

- Lifestyle factors such as diet appear to play a significant role in the development of AD
- Various predominantly plant-based dietary patterns (e.g., the Mediterranean diet) have demonstrated a protective effect on the risk of AD
- A vegan diet is often richer in nutrients with a favorable effect on AD risk (fiber, Vitamin C, PUFAs, folate, antioxidants), but at the same time, also carries the risk of deficiency in other crucial substances for the nervous system, such as Vitamin B12, Vitamin D, and EPA/DHA
- Additional research is needed to investigate the effects of a vegan diet on the risk of AD
- Vegans should plan their diet carefully to prevent potential deficiencies through supplementation of critical nutrients

Dementia is on the rise in the general population. According to the World Health Organization (WHO) and Alzheimer's Disease International (ADI), in the year 2019, more than 50 million people were affected, and it is estimated that by the year 2050, the number will reach almost 152 million[i]. In addition to the main risk factor “ageing”, other risk factors such as genetic predisposition, diabetes mellitus, cardiovascular diseases, and lifestyle factors appear to play a role in the development of dementia. Concerning lifestyle and dietary patterns there is some evidence suggesting that predominantly plant-based diets, such as the Mediterranean diet, could play a protective role against the development of dementia and Alzheimer's disease (AD)[ii], while typical Western-style diets seem to increase the risk[iii].

Western-Style dietary patterns versus plant-based diets

A high consumption of legumes and nuts appears to slow cognitive decline[iv], and so does a high intake of fruits and vegetables, especially when consumed in a wide variety [v]. Other protective dietary factors seem to include dietary fiber [vi] and tocopherols[vii], primarily found in fruits, vegetables, grains, and legumes. The *'Salus in Apulia Study'* showed an inverse association between the consumption of vegetables, coffee, and sources of Vitamin A, and cognitive decline in elderly Italian subjects[viii].

According to the cohort study conducted by the *UK Biobank*, analyzing the dietary habits of 293,888 English subjects, the consumption of processed meat appears to

increase the risk of dementia (HR 1.44, 95% CI 1.24-1.67 at a consumption of 25g) and AD (HR 1.52, 95% CI 1.18-1.96), while the consumption of unprocessed red or white meat does not show a similar association[ix]. In the prospective '*Women's Health Initiative'*-Study, processed meat consumption was also associated with increased dementia-related mortality in postmenopausal women (HR 1.20; 95% CI 1.05-1.32), while consumption of unprocessed white meat was linked to a lower risk (HR 0.86; 95% CI 0.75-0.98)[x]. A high intake of saturated fatty acids (which are particularly abundant in animal fats such as dairy products and fatty meats) was associated with a decline in global cognitive function and verbal memory in the '*Women's Health Study'*, while the consumption of monounsaturated fats (especially in certain vegetable oils like olive oil, canola oil, nuts, seeds, avocado) exhibited a protective effect[xi].

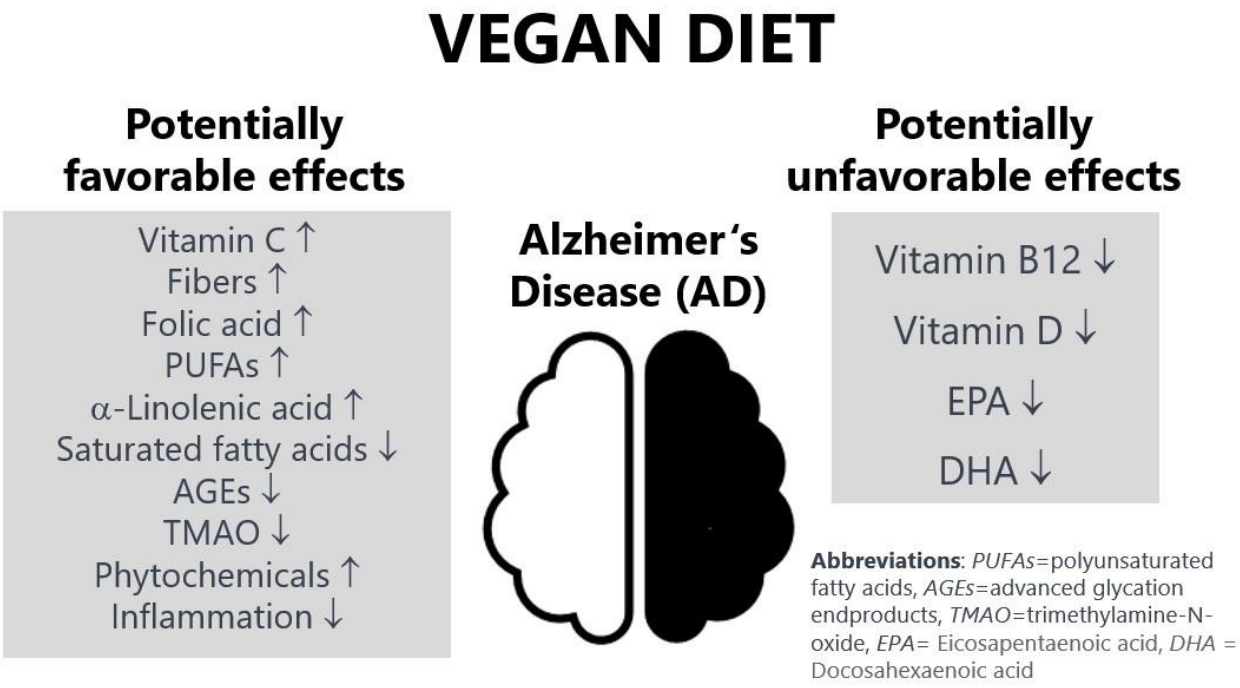
What about strictly vegan diets?

Very limited information exists regarding the association between vegan dietary patterns and dementia. In an analysis of the '*Adventist Health Study*' (AHS) from the 1990s, participants who consumed meat and fish had a two-fold higher risk of developing dementia compared to vegetarians (RR 2.18, p=0.065)[xii]. Moreover vegan diets, compared to an omnivorous dietary pattern, are generally richer in polyunsaturated fatty acids (PUFAs), α-linolenic acid (ALA), folate, vitamin C, E and magnesium, but lower in vitamin B12, vitamin D, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), iron, zinc, iodine and calcium[xiii]. On the one hand, the higher content of vitamin C, folic acid, and PUFAs in a vegan diet could be advantageous in the prevention of dementia, including AD (figure 1), but on the other hand, deficiencies in vitamin B12, D or EPA/DHA could potentially contribute to the development of the disease[xiv]. However, the high content of secondary plant compounds in a plant-based diet, including many with antioxidant functions, could potentially provide protection against AD[xv].
On the contrary, advanced glycosylation end products (AGEs), which are present in high amounts in meat-heavy Western-style diets, but much lower in plant-based foods[xvi], could play a role in the development of AD[xvii]. Additional mechanisms that could contribute to primary and secondary risk reduction for Alzheimer's disease (AD) include the anti-inflammatory effect of a vegan diet[xviii,xix] and the reduced production of trimethylamine-N-oxide (TMAO) by the microbiota in vegans[xx].

Conclusion

In conclusion, despite the potential benefits of a vegan diet displayed by current literature, further research, including prospective cohort studies, is needed to demonstrate whether a 100% plant-based diet could play a role in the primary and secondary prevention of AD. Individuals who wish to adopt a vegan approach should carefully plan their diet to ensure the adequate intake or supplement of critical nutrients such as Vitamin B12, Vitamin D, and long-chain omega-3 fatty acids.

Figure 1: **Potential favorable and unfavorable effects of a vegan diet on Alzheimer's Disease risk**



References

[i] Gauthier S, Rosa-Neto P, Morais JA, & Webster C. 2021. World Alzheimer Report 2021: Journey through the diagnosis of dementia. London, England: Alzheimer's Disease International

[ii] Samuelsson J, Kern S, Zetterberg H, Blennow K, Rothenberg E, Wallengren O, Skoog I, Zettergren A. A Western-style dietary pattern is associated with cerebrospinal fluid biomarker levels for preclinical Alzheimer's disease-A population-based cross-sectional study among 70-year-olds. Alzheimers Dement (N Y). 2021 May 18;7(1):e12183

[iii] an de Rest O, Berendsen AA, Haveman-Nies A, de Groot LC. Dietary patterns, cognitive decline, and dementia: a systematic review. Adv Nutr. 2015;6(2):154-168

[iv] Chen X, Liu Z, Sachdev PS, Kochan NA, O'Leary F, Brodaty H. Association of Dietary Patterns With Cognitive Function and Cognitive Decline in Sydney Memory and Ageing Study: A Longitudinal Analysis. J AcadNutr Diet. 2021;S2212-2672(21)01425-8

[v] Wu L, Sun D, Tan Y. Intake of Fruit and Vegetables and the Incident Risk of Cognitive Disorders: A Systematic Review and Meta-Analysis of Cohort Studies. J Nutr Health Aging. 2017;21(10):1284-1290

[vi] Yamagishi K, Maruyama K, Ikeda A, et al. Dietary fiber intake and risk of incident disabling dementia: the Circulatory Risk in Communities Stud. NutrNeurosci. 2022;1-8

[vii] Aoki S, Yamagishi K, Maruyama K, et al. Dietary intake of tocopherols and risk of incident disabling dementia. Sci Rep. 2021;11(1):16429

[viii] Zupo R, Griseta C, Battista P, Donghia R, Guerra V, Castellana F, Lampignano L, Bortone I, Lozupone M, Giannelli G, De Pergola G, Boeing H, Sardone R, Panza F. Role of plant-based diet in late-life cognitive decline: results from the Salus in Apulia Study. Nutr Neurosci. 2022 Jun;25(6):1300-1309

[ix] Zhang H, Greenwood DC, Risch HA, Bunce D, Hardie LJ, Cade JE. Meat consumption and risk of incident dementia: cohort study of 493,888 UK Biobank participants. Am J Clin Nutr. 2021;114(1):175-184

[x] Sun Y, Liu B, Snetselaar LG, et al. Association of Major Dietary Protein Sources with All-Cause and Cause-Specific Mortality: Prospective Cohort Study. J Am Heart Assoc. 2021;10(5):e015553

[xi] Okereke OI, Rosner BA, Kim DH, Kang JH, Cook NR, Manson JE, Buring JE, Willett WC, Grodstein F. Dietary fat types and 4-year cognitive change in community-dwelling older women. Ann Neurol. 2012 Jul;72(1):124-34

[xii] Giem P, Beeson WL, Fraser GE. The incidence of dementia and intake of animal products: preliminary findings from the Adventist Health Study. Neuroepidemiology. 1993;12(1):28-36

[xiii] Neufingerl N, Eilander A. Nutrient Intake and Status in Adults Consuming Plant-Based Diets Compared to Meat-Eaters: A Systematic Review. Nutrients. 2021 Dec 23;14(1):29

[xiv] Katonova A, Sheardova K, Amlerova J, Angelucci F, Hort J. Effect of a Vegan Diet on Alzheimer's Disease. Int J Mol Sci. 2022 Nov 29;23(23):14924

[xv] Collins AE, Saleh TM, Kalisch BE. Naturally Occurring Antioxidant Therapy in Alzheimer's Disease. *Antioxidants*. 2022; 11(2):213

[xvi] Collins AE, Saleh TM, Kalisch BE. Naturally Occurring Antioxidant Therapy in Alzheimer's Disease. *Antioxidants*. 2022; 11(2):213

[xvii] Batkulwar K, Godbole R, Banarjee R, Kassaar O, Williams RJ, Kulkarni MJ. Advanced Glycation End Products Modulate Amyloidogenic APP Processing and Tau Phosphorylation: A Mechanistic Link between Glycation and the Development of Alzheimer's Disease. ACS Chem Neurosci. 2018 May 16;9(5):988-1000

[xviii] Sutliffe JT, Wilson LD, de Heer HD, Foster RL, Carnot MJ. C-reactive protein response to a vegan lifestyle intervention. Complement Ther Med. 2015 Feb;23(1):32-7.

[xix] Menzel J, Jabakhanji A, Biemann R, Mai K, Abraham K, Weikert C. Systematic review and meta-analysis of the associations of vegan and vegetarian diets with inflammatory biomarkers. Sci Rep. 2020 Dec 10;10(1):21736

[xx] Koeth RA, Wang Z, Levison BS, Buffa JA, Org E, Sheehy BT, Britt EB, Fu X, Wu Y, Li L, Smith JD, DiDonato JA, Chen J, Li H, Wu GD, Lewis JD, Warrier M, Brown JM, Krauss RM, Tang WH, Bushman FD, Lusis AJ, Hazen SL.

Intestinal microbiota metabolism of L-carnitine, a nutrient in red meat, promotes atherosclerosis. Nat Med. 2013 May;19(5):576-85

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