

Protective Effects of Nut Consumption in Cognitive Dysfunction

PHD STUDENT CARLOS GÓMEZ-MARTÍNEZ AND PROF. JORDI SALAS-SALVADÓ

Human Nutrition Unit, Department of Biochemistry and Biotechnology, Hospital Universitari de Sant Joan de Reus, Faculty of Medicine and Health Sciences, IISPV Institut d'Investigació Sanitària Pere Virgili, Universitat Rovira i Virgili, Reus (Spain). CIBER Obesity and Nutrition Network (CIBEROBN), Carlos III Health Institute, Madrid (Spain).



Prof. Jordi Salas-Salvadó

Dementia is a major public health problem and non-pharmacological treatments are currently effective. Nut consumption is presented as a possible protective factor for neurodegeneration due to an improvement on cognitive function.

Cognitive dysfunction is characterized by decrements in cognitive abilities, ranging from subtle cognitive impairments to dementia, the most severe form of neurodegeneration. Dementia is one of the major causes of disability and dependency among older people worldwide, affecting memory, thinking, orientation, comprehension, calculation, learning capacity, language, and judgement. The impairment in cognitive function is commonly accompanied, and occasionally preceded, by deterioration in emotional control, social behavior, or motivation. Nowadays, around 50 million people have dementia and every year there are nearly 10 million new cases. The total number of people with dementia is projected to reach 82 million in 2030 and 152 million by 2050, and it was estimated to have an impact of 818 billion dollars on the global economy in 2015, increasing to 2 trillion dollars in 2030¹.

Furthermore, it is important to point out that there is no effective pharmacological treatment for neurodegeneration². Therefore, it is crucial to identify the initial stages of cognitive dysfunction in the population at risk to promote healthier lifestyle habits which may slow or ameliorate the progression of cognitive dysfunction. One of these favorable lifestyle characteristics is the Mediterranean diet, which is widely known for its beneficial effects in neuropsychological function³. In fact, emerging epidemiological and clinical trials suggest that long-term consumption of nuts, a characteristic compound in the Mediterranean diet, may improve cognitive function as well as reduce cognitive dysfunction⁴.

The biological mechanisms underlying this benefit are not well established yet. Nevertheless, frequent nut consumption has been shown to have a potential role in the reduction of oxidative stress and inflammation, protecting against mitochondrial dysfunction and neural damage due to the high concentrations of antioxidants including polyphenols, vitamins, and mono- and polyunsaturated fatty acids (MUFA and PUFA). Specifically, MUFA has been demonstrated to improve pancreatic β -cell function and insulin sensitivity, whereas PUFA might act on the central nervous system protecting neuronal and cell-signaling function and maintenance⁵. Then, the β -amyloid accumulation on the central nervous system, the main characteristic of the most prevalent manifestation of dementia (Alzheimer disease), might be reduced indirectly with the consumption of nuts through an enhancement in the insulin sensitivity in brain and pancreas by MUFA, while PUFA may allow optimal communication between neural cells due to an improved cell-signal.



A recent paper has reviewed all the studies analyzing the beneficial effects of walnuts on neuropsychological dysfunction⁶. The review showed favorable associations between walnut consumption and neuropsychological function for both animal and human studies. When Alzheimer disease was experimentally induced in mice, the animals that were fed walnuts during the 14-month showed an improvement in memory, learning skills, motor development, and anxiety-related behavior compared with control diets without walnuts. In another study with aged rats (19 months old), it has been observed that walnut supplementation induces improvements in cognitive and motor performance. Concerning humans, three clinical trials have shown better cognitive function in those participants with long-term consumption of nuts compared with participants avoiding nuts. Specifically, some of them find positive effects on verbal skills and memory function. Moreover, a short-term study of 8 weeks showed that both younger (20-59 years) and older (≥ 60 years) populations present higher cognitive scores after nut supplementation compared with those that do not have been supplemented.

The most recent large randomized controlled trial (RCT) performed evaluating the effects of nut consumption on cognitive function is the Walnuts And Healthy Aging (WAHA) study⁷. This kind of experimental design (RCTs) provides the strongest scientific evidence of effects and can be used to give population recommendations in the future. WAHA was conducted in Barcelona (Spain) and Loma Linda (California). It is a RCT of 2 years of follow-up, including 636 elderly participants. In this study, global cognitive function has been measured as a composite of several neuropsychological tests including memory, language, perception, and executive function domains. These scores have been standardized in order to compare data. Results based on the observed mean of global cognitive changes over 2 years for the Barcelona sample showed significant differences between those individuals supplemented with walnuts compared to the controls, indicating less impairment in global cognitive function for those supplemented with 30 to 60 g/day of walnuts compared to those in the control group. Nonetheless, in Loma Linda participants these effects have not been reported. In the case of the Spanish participants, it was in the perception performance cognitive domain that more benefits have been reported after nut consumption.

A total of 108 participants from the Barcelona WAHA study were included in a neuroimaging sub study using Magnetic Resonance Imaging (MRI) and functional MRI (fMRI) to analyze the effect of walnut consumption on brain structure and

“ In fact, emerging epidemiological and clinical trials suggest that long-term consumption of nuts, a characteristic compound in the Mediterranean diet, may improve cognitive function as well as reduce cognitive dysfunction. ”

function. Regarding the brain structure, the rates of brain atrophy, white matter hyperintensity and amount of blood taken to brain areas present similar rates for both groups. However, only for the control group, fMRI data indicates that those brain regions related to working memory function significantly increase the activity after the intervention. Then, it might be that people who do not consume walnuts have more risk of cognitive decline due to overstimulation of brain regions responsible for working memory performance⁷. In this sense, in another recent cohort Italian study, nuts implementation in dietary patterns during 3 years significantly reduced the risk of cognitive decline for both dietary and urinary markers compared to the control group⁸.

To conclude, research shows some evidence in the line of a beneficial effect of nut consumption and neuropsychological function, specifically for walnuts. However, as it is an emerging field of research interest it would be necessary to promote more studies to obtain enough data to sustain in the future that nut consumption may improve cognitive function and protect against cognitive impairment. ■

References

1. November 2, 2020. <https://www.who.int/news-room/fact-sheets/detail/dementia>
2. Bhatti GK, Reddy AP, Reddy PH, Bhatti JS. Lifestyle Modifications and Nutritional Interventions in Aging-Associated Cognitive Decline and Alzheimer's Disease. *Front Aging Neurosci.* 2020;11. doi:10.3389/fnagi.2019.00369
3. Petersson SD, Philippou E. Mediterranean Diet, Cognitive Function, and Dementia: A Systematic Review of the Evidence. *Adv Nutr.* 2016;7(5):889-904. doi:10.3945/an.116.012138
4. Alasalvar C, Salvador J-S, Ros E. Bioactives and health benefits of nuts and dried fruits. *Food Chem.* 2020;314:126192. doi:10.1016/j.foodchem.2020.126192
5. Grosso G, Estruch R. Nut consumption and age-related disease. *Maturitas.* 2016;84:11-16. doi:10.1016/j.maturitas.2015.10.014
6. Chauhan A, Chauhan V. Beneficial Effects of Walnuts on Cognition and Brain Health. *Nutrients.* 2020;12(2):550. doi:10.3390/nu12020550
7. Sala-Vila A, Valls-Pedret C, Rajaram S, et al. Effect of a 2-year diet intervention with walnuts on cognitive decline. The Walnuts And Healthy Aging (WAHA) study: a randomized controlled trial. *Am J Clin Nutr.* 2020;111(3):590-600. doi:10.1093/ajcn/nqz328
8. Rabassa M, Zamora-Ros R, Palau-Rodriguez M, et al. Habitual Nut Exposure, Assessed by Dietary and Multiple Urinary Metabolomic Markers, and Cognitive Decline in Older Adults: The InCHIANTI Study. *Mol Nutr Food Res.* 2020;64(2):1900532. doi:10.1002/mnfr.201900532