



# Antioxidant Effects of Olive Leaf Extract in Prevention of Alzheimer's Disease and Parkinson's Disease

Maryam Sarbishegi<sup>1\*</sup>

<sup>1</sup>Cellular and Molecular Research Center and Department of Anatomy, School of Medicine, Zahedan University of Medical Sciences, Zahedan, IR Iran

\*Corresponding author: Maryam Sarbishegi, Cellular and Molecular Research Center and Department of Anatomy, School of Medicine, Zahedan University of Medical Sciences, Zahedan, IR Iran. Tel: +98-33295715-19, Fax: +98-33291124, E-mail: msarbishegi@yahoo.co.in

Received 2017 April 01; Accepted 2017 April 20.

**Keywords:** Olive Leaf Extract, Antioxidant Effects, Alzheimer's Disease, Parkinson's Disease

## Dear Editor,

During the last decade some studies have focused on the important role of phenolic compounds from dietary plants in prevention and management of neurodegenerative disorders such as Alzheimer's disease (AD) and Parkinson's disease (PD).

The role of oxidative stress in development of AD and PD is well established (1) and medicinal herbs with phenolic compound have antioxidant properties are studied as disease-modifying strategies in neurodegenerative diseases. It is proposed that pretreatment with antioxidants can delay neuronal death. Olive products are full of phenolic compound and the main phenolic constituents in olive leaf extract (OLE) are oleuropein and hydroxytyrosol (HT), which are the responsible for the therapeutic effects (2).

OLE has shown antioxidant, anti-inflammatory, and neuroprotective properties. It converts the hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) to H<sub>2</sub>O and inhibits H<sub>2</sub>O<sub>2</sub> accumulation and leads to cell protection, which could be of interest as a potential treatment of some neurodegenerative disease such as AD and PD (3).

Hippocampal CA1 region and dopaminergic neurons in the substantia nigra are the most vulnerable regions against oxidative stress, which respectively damage in AD and PD (4).

AD is the first common neurodegenerative disease, which is characterized by aggregation of amyloid- $\beta$  peptide (A $\beta$ ) and intracellular neurofibrillary tangles, which leads to oxidative stress, mitochondrial dysfunction, and pathological cascades of events that cause cell death. Aggregation of A $\beta$  also leads to oxidative stress and mitochondrial dysfunction (5).

It has shown that oleuropein and HT increased clearance A $\beta$  and inhibits Tau aggregation in AD. Therapeutic

role of olive leaf extract derivatives, as neuroprotective compounds has also been confirmed *in vitro* in AD models (6).

Luccarini et al., reported that oleuropein reduces deposition of A $\beta$  and improved the cognitive performance in old rats (7).

PD is another neurodegenerative disease, which is characterized by the irreversible degeneration of nigrostriatal neurons. Dopamine metabolism and mitochondrial dysfunction are the major sources for reactive oxygen species (ROS) generation in nigrostriatal neurons, which caused neuronal dysfunction and induced development of PD (8).

Oxidative stress leads to peroxidation of the mitochondria-specific lipid cardiolipin, which induces release of cytochrome c to the cytosol and apoptosis (9).

The finding of our recent study confirmed that OLE preserved neuronal cells against Parkinson-like disease in male rats. Our results confirmed that OLE, by quenching the hydroxyl radicals, decreased lipid peroxidation and enhanced antioxidant enzyme activity in the substantia nigra of mid brain, which protects neurons from harmful effects of oxidative stress (10).

On the other hand OLE inhibited efflux of lactate dehydrogenase, which is a marker of neuronal damage, and protects neuronal cells against hypoxia-reoxygenation in rat brain slices. This finding did not report with N-acetylcysteine and vitamin E (11). Another study reported that OLE, with antioxidant properties, reduced free radicals in the skin of aged mouse and accelerated wound healing (12). In another research, we reported that OLE increased the level of GPX, SOD, CAT, and decreased MDA level in midbrain of and preserves dopaminergic cells in aged rats (13).

It has been described that HT protects neurons against oxidative stress in a Huntington disease model on rats. The obtained results revealed that HT increase antioxidant enzyme and decrease lipid peroxidation in the brain (14).

In conclusion, it seems OLE, with antioxidant effects, has a good potential therapeutic effect for prevention of neurodegenerative diseases; however, further research in humans is needed.

## References

- Rodriguez-Morato J, Xicota L, Fito M, Farre M, Dierssen M, de la Torre R. Potential role of olive oil phenolic compounds in the prevention of neurodegenerative diseases. *Molecules*. 2015;**20**(3):4655–80. doi: [10.3390/molecules20034655](https://doi.org/10.3390/molecules20034655). [PubMed: [25781069](https://pubmed.ncbi.nlm.nih.gov/25781069/)].
- Essa M, Braidy N, Bridge W, Subash S, Manivasagam T, Vijayan R. Review of natural products on Parkinson's disease pathology. *J Aging Res Clin Pract*. 2014;**3**(1):1–8.
- Pasban-Aliabadi H, Esmaeili-Mahani S, Sheibani V, Abbasnejad M, Mehdizadeh A, Yaghoobi MM. Inhibition of 6-hydroxydopamine-induced PC12 cell apoptosis by olive (*Olea europaea* L.) leaf extract is performed by its main component oleuropein. *Rejuvenation Res*. 2013;**16**(2):134–42. doi: [10.1089/rej.2012.1384](https://doi.org/10.1089/rej.2012.1384). [PubMed: [23394606](https://pubmed.ncbi.nlm.nih.gov/23394606/)].
- Gandhi S, Abramov AY. Mechanism of oxidative stress in neurodegeneration. *Oxid Med Cell Longev*. 2012;**2012**. doi: [10.1155/2012/428010](https://doi.org/10.1155/2012/428010).
- Schoneich C, Hewarathna A, Pal R, Jiang L, Michaelis E. Oxidative stress markers of Alzheimer's disease in peripheral cell mitochondria. *Free Radic Biol Med*. 2017;**108**. S100. doi: [10.1016/j.freeradbiomed.2017.04.321](https://doi.org/10.1016/j.freeradbiomed.2017.04.321).
- Rigacci S. Olive Oil Phenols as Promising Multi-targeting Agents Against Alzheimer's Disease. *Adv Exp Med Biol*. 2015;**863**:1–20. doi: [10.1007/978-3-319-18365-7\\_1](https://doi.org/10.1007/978-3-319-18365-7_1). [PubMed: [26092624](https://pubmed.ncbi.nlm.nih.gov/26092624/)].
- Luccarini I, Grossi C, Rigacci S, Coppi E, Pugliese AM, Pantano D, et al. Oleuropein aglycone protects against pyroglutamylated-3 amyloid-ss toxicity: biochemical, epigenetic and functional correlates. *Neurobiol Aging*. 2015;**36**(2):648–63. doi: [10.1016/j.neurobiolaging.2014.08.029](https://doi.org/10.1016/j.neurobiolaging.2014.08.029). [PubMed: [25293421](https://pubmed.ncbi.nlm.nih.gov/25293421/)].
- Alizadeh R, Hassanzadeh G, Joghataei MT, Soleimani M, Moradi F, Mohammadpour S, et al. In vitro differentiation of neural stem cells derived from human olfactory bulb into dopaminergic-like neurons. *Eur J Neurosci*. 2017;**45**(6):773–84. doi: [10.1111/ejn.13504](https://doi.org/10.1111/ejn.13504). [PubMed: [27987378](https://pubmed.ncbi.nlm.nih.gov/27987378/)].
- Hwang O. Role of oxidative stress in Parkinson's disease. *Exp Neurol*. 2013;**22**(1):11–7. doi: [10.5607/en.2013.22.1.11](https://doi.org/10.5607/en.2013.22.1.11). [PubMed: [23585717](https://pubmed.ncbi.nlm.nih.gov/23585717/)]. [PubMed Central: [PMC3620453](https://pubmed.ncbi.nlm.nih.gov/PMC3620453/)].
- Sarbishegi M, Charkhat Gorgich EA, Khajavi O, Komeili G, Salimi S. The neuroprotective effects of hydro-alcoholic extract of olive (*Olea europaea* L.) leaf on rotenone-induced Parkinson's disease in rat. *Metab Brain Dis*. 2018;**33**(1):79–88. doi: [10.1007/s11011-017-0131-0](https://doi.org/10.1007/s11011-017-0131-0). [PubMed: [29039078](https://pubmed.ncbi.nlm.nih.gov/29039078/)].
- Gonzalez-Correa JA, Navas MD, Lopez-Villodres JA, Trujillo M, Espartero JL, De La Cruz JP. Neuroprotective effect of hydroxytyrosol and hydroxytyrosol acetate in rat brain slices subjected to hypoxia-reoxygenation. *Neurosci Lett*. 2008;**446**(2-3):143–6. doi: [10.1016/j.neulet.2008.09.022](https://doi.org/10.1016/j.neulet.2008.09.022). [PubMed: [18809463](https://pubmed.ncbi.nlm.nih.gov/18809463/)].
- Mehraein F, Sarbishegi M, Aslani A. Evaluation of effect of oleuropein on skin wound healing in aged male BALB/c mice. *Cell J*. 2014;**16**(1):25–30. [PubMed: [24518972](https://pubmed.ncbi.nlm.nih.gov/24518972/)]. [PubMed Central: [PMC3933436](https://pubmed.ncbi.nlm.nih.gov/PMC3933436/)].
- Mehraein F, Sarbishegi M, Golipoor Z. Different effects of olive leaf extract on antioxidant enzyme activities in midbrain and dopaminergic neurons of Substantia Nigra in young and old rats. *Histol Histopathol*. 2016;**31**(4):425–31. doi: [10.14670/hh-11-687](https://doi.org/10.14670/hh-11-687). [PubMed: [26559661](https://pubmed.ncbi.nlm.nih.gov/26559661/)].
- Tasset I, Pontes AJ, Hinojosa AJ, de la Torre R, Tunes I. Olive oil reduces oxidative damage in a 3-nitropropionic acid-induced Huntington's disease-like rat model. *Nutr Neurosci*. 2011;**14**(3):106–11. doi: [10.1179/1476830511y.0000000005](https://doi.org/10.1179/1476830511y.0000000005). [PubMed: [21756531](https://pubmed.ncbi.nlm.nih.gov/21756531/)].