The bergamot juice protects against cell death in an in vitro model of Parkinson's disease

Cirmi S., Ferlazzo N., Musumeci L., Russo C., Maugeri A., Lombardo G. E., Navarra M.

Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, Messina, Italy

Abstract (300 word limit)

Citrus bergamia Risso et Poiteau (bergamot) is a small tree belonging to the Rutaceae family, that grows almost exclusively in the Calabria region (Italy). Bergamot fruit is used mostly for the extraction of the essential oil, while its juice (BJ) has been treated as waste product for long time. In the last decade, BJ has gained increasing attention in the scientific community for its beneficial effects1,2,3. Many of the biological activities ascribed to BJ are due to its flavonoids, that have widely revealed their potential neuroprotective effect4. The SH-SY5Y human neuroblastoma cells along with the 6-hydroxydopamine (6-OHDA) and the hydrogen peroxide (H_2O_2) are commonly used as experimental model of Parkinson's disease (PD).

The aim of our study was to evaluate the protective effect of BJ against 6-OHDA- or H_2O_2-induced neurotoxicity in the SH-SY5Y cells.

Treatment of differentiated SH-SY5Y cells with 6-OHDA or H_2O_2 resulted in cell death, that was significantly inhibited by the pre-incubation with BJ. In addition, it reduced both intracellular reactive oxygen and nitrogen species induced by 6-OHDA or H_2O_2, as well as restored the mitochondrial membrane potential. Moreover, the Annexin-V test suggested that BJ inhibited the 6-OHDA- or H_2O_2-induced apoptosis. The mechanisms by which BJ exerted neuroprotective effect involved the inhibition of NF-κB activation, the reduction of p53 and Bax, as well as the up-regulation of Bcl-2 proteins, in addition to the inhibition of the caspase 3 activation. Furthermore, BJ prevented both p38 and ERK1/2 phosphorylation evoked by the neurotoxic agents. Additionally, BJ exhibited excellent antioxidant capability in cell free assays.

Overall, these results indicate that BJ exerts neuroprotective effects against 6-OHDA- or H_2O_2-induced cell death in SH-SY5Y cells by mechanisms involving both the specific interaction with intracellular pathways and its antioxidant capability. Our study suggests a novel possible strategy to prevent and/or ameliorate neurodegenerative diseases, such as PD.

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Recent Publications (minimum 5)

1. Cirmi S, Ferlazzo N, Gugliandolo A, Musumeci L, Mazzon E, Bramanti A, Navarra M. Moringin from Moringa Oleifera Seeds Inhibits Growth, Arrests Cell-Cycle, and Induces Apoptosis of SH-SY5Y Human Neuroblastoma Cells through the Modulation of NF-κB and Apoptotic Related Factors. Int J Mol Sci (2019) 20(8). pii: E1930.
2. Maugeri A, Cirmi S, Minciullo PL, Gangemi S, Calapai G, Mollace V, Navarra M. Citrus fruits and inflammaging: a systematic review. Phytochemistry Reviews, pp 1–25
3. Navarra M, Femia AP, Romagnoli A, Tortora K, Luceri C, Cirmi S, Ferlazzo N, Caderni G. A flavonoid-rich extract from bergamot juice prevents carcinogenesis in a genetic model of colorectal cancer, the Pirc rat (F344/NTac-Apcam1137). Eur J Nutr. (2019).
4. Cirmi S, Navarra M, Woodside JV, Cantwell MM. Citrus fruits intake and oral cancer risk: a systematic review and meta-analysis. Pharmacol Res. 2018 May 10. pii: S1043-618(18)30472-9.
5. Cirmi S, Maugeri A, Ferlazzo N, Gangemi S, Calapai G, Schumacher U, Navarra M. Anticancer Potential of Citrus Juices and Their Extracts: A Systematic Review of Both Preclinical and Clinical Studies. Front Pharmacol. (2017) 8:420

Biography (150 word limit)

- March 20th, 2013: Degree in Pharmacy, University of Messina, Italy
- January 17th, 2017: PhD in Applied Biology and Experimental Medicine, University of Messina, Italy
- November 23th, 2018: advanced master course on Biostatistics and Epidemiologic Methodology, University of Pavia, Italy
- January, 2017 – December, 2018: two-year research fellowship funded by the "Fondazione Prof. Antonio Imbesi" on the epidemiologic study of natural products and chronic diseases, University of Messina, Messina (IT)
- August, 2016 – October 2017: Research Fellow at the Nutrition Group of the Institute for Global Food Security/Centre for Public Health at Queen's University

in Belfast, Belfast (UK)

- July, 2018 – July 2019: Research Fellow at Department of Medical Pharmacology at the University of Bordeaux, Bordeaux (FR)
- Farmindustria 2018 Award: prize for the quality of research in the pharmacological field.

She started her research path performing experimental pharmacological studies on extracts and bioactive compounds present in food, focusing in the last years on their epidemiologic relevance.

Email: scirmi@unime.it

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