

Gardenia Jasminoides Fruit Extract Exhibits a Neuroprotective Effect in an In Vitro Neurotoxicity Model

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Introduction :

Alzheimer’s disease (AD) is a prevalent neurodegenerative disorder, which is characterized by progressive loss of neuronal cells, amyloid plaques accumulation, and neurofibrillary tangles (NFT) in different brain regions, ultimately leading to functional cognitive impairment. Effective therapies for neurodegenerative diseases (NDs) remain a major clinical challenge.

Neuroprotection is a promising strategy to slow disease progression and enhance cognitive function. Natural compound, such as those found in Gardenia Jasminoides (Figure 1), which is an evergreen flowering plant in the coffee family Rubiaceae. It is native to parts of South-East Asia.

Geniposide, an iridoid glycoside isolated from the fruit of the Chinese herbal medicine G. jasminoides Ellis, has a variety of pharmacological functions such as anti-inflammatory, antioxidant, anti-tumor, neurotrophic, and neuroprotective effects.

In this project we assessed the neuroprotective activity of geniposide in an in vitro neurotoxicity model using zinc sulfate (100 μ M) on neuroblastoma SH-SY5Y cells.

The results show that Zinc sulfate (100 μ M, for 4 hours) induced neurotoxicity on Neuroblastoma SH-SY5Y cells. Pretreatment of the cells with Gardenia Jasminoides extract (75 μ M, for 2 hours) significantly reversed the zinc-induced cytotoxicity, enhancing cell viability.

Zinc sulfate (100 μ M) significantly activated the apoptotic BAX/BCL-2 pathway in Neuroblastoma SH-SY5Y cells, while reversed the effects of Zinc sulfate.

These preliminary findings suggest that Gardenia Jasminoides extract has a promising neuroprotective activity in vitro.

CONCLUSIONS:

Gardenia Jasminoides extract shows promising neuroprotective potential in an in vitro model of Zinc induced Neurotoxicity.

Cytotoxicity and Viability Assays

SH-SY5Y neuroblastoma Cell viability was assessed by using MTT Cytotoxicity assay.

Zinc sulfate (100 μ M) significantly reduced SH-SY5Y cell viability in a dose-dependent manner.

Gardenia jasminoides extract (75 μ M) increased cell viability and reversed Zinc-induced cytotoxicity.

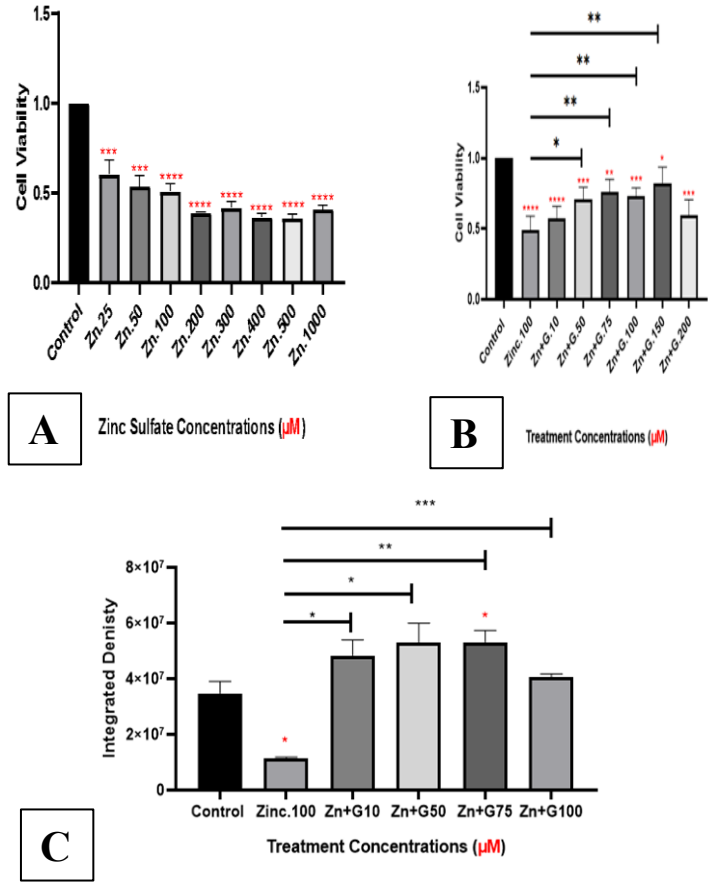


Figure 1: Zinc sulfate (A) has a significant cytotoxic effect on Neuroblastoma SH SY5Y cells. Pre-treatment with Gardenia jasminoides extract for 2h (B) reverses the cytotoxic effect of Zinc sulfate (100 μ M) significantly. C) Quantification of cell viability.

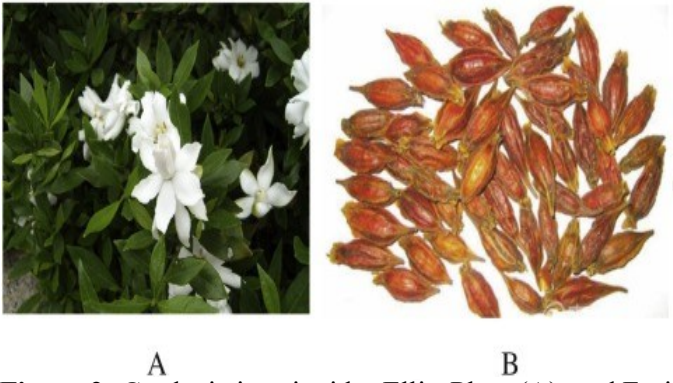


Figure 2: Gardenia jasminoides Ellis, Plant (A), and Fruit (B).

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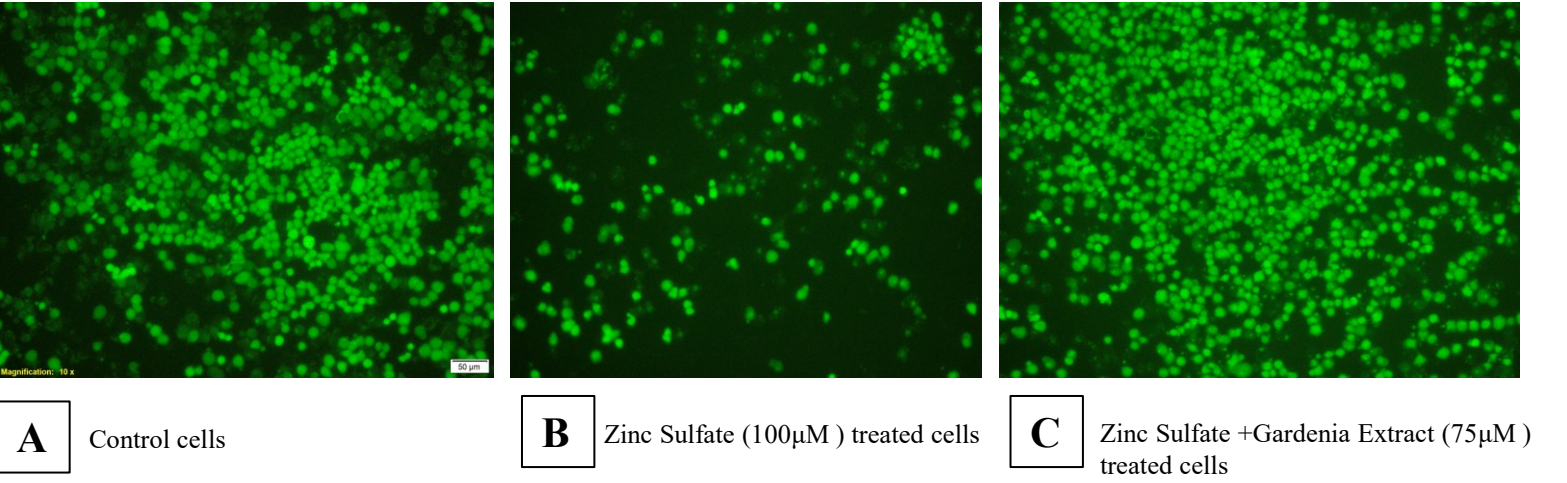
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Live/Dead Assay Confirmation

Viable cells were stained with Calcein-AM (Figure 3), and fluorescence was detected using a microscope. ImageJ® was used to quantify cell numbers and integrated fluorescence intensity. Calcein-AM staining confirmed that 75 μ M Gardenia jasminoides extract offered the highest neuroprotection against zinc sulfate cytotoxicity.



Gene Expression Analysis

Zinc sulfate (100 μ M) significantly activated the apoptotic BAX/BCL-2 pathway. The BAX/BCL-2 ratio was >1 indicating apoptotic changes in Neuroblastoma cells.

Treatment with Gardenia jasminoides extract (75 μ M) increased cell viability and reversed Zinc-induced cytotoxicity, as shown by lower BAX/BCL-2 ratios (<1). The extract alone showed no apoptotic effects (BAX/BCL-2 ratio = 1).

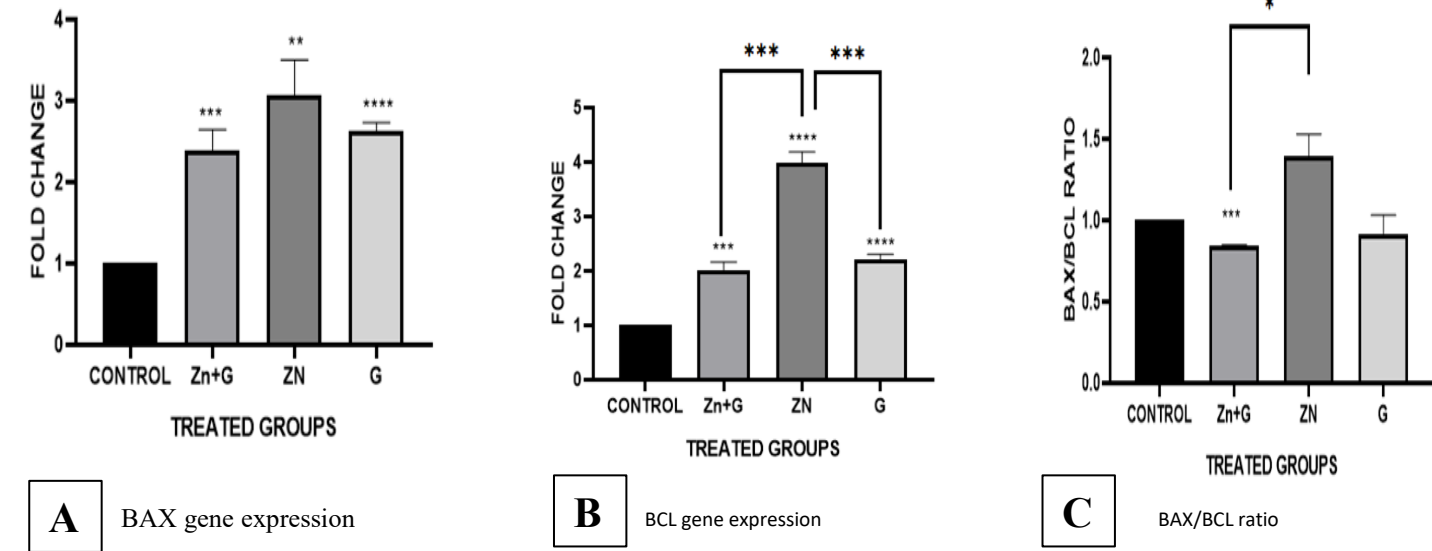


Figure 4: Gene Expression Analysis of BAX and BCL-2 genes in SH-SY5Y cells treated with 100uM of Zinc Sulfate and 75uM of Gardenia jasminoides extract.

References:

Adamo, A. M., Zago, M. P., Mackenzie, G. G., Aimò, L., Keen, C. L., Keenan, A., & Oteiza, P. I. (2010). The Role of Zinc in the Modulation of Neuronal Proliferation and Apoptosis. *Neurotoxicity Research*, 17(1), 1–14. <https://doi.org/10.1007/s12640-009-9067-4>

Elufioye, T. O., Berida, T. I., & Habtemariam, S. (2017). Plants-Derived Neuroprotective Agents: Cutting the Cycle of Cell Death through Multiple Mechanisms. *Evidence-Based Complementary and Alternative Medicine*, 2017(1), 3574012. <https://doi.org/10.1155/2017/3574012>

Zhang, X., Liu, K., Shi, M., Xie, L., Deng, M., Chen, H., & Li, X. (2021). Therapeutic potential of catalpol and geniposide in Alzheimer’s and Parkinson’s diseases: A snapshot of their underlying mechanisms. *Brain Research Bulletin*, 174, 281–295. <https://doi.org/10.1016/j.brainresbull.2021.06.020>