



**PHENYLALANINE AMMONIA LYASE GENE EXPRESSION AND ACCUMULATION OF PHENOLIC COMPOUNDS IN *SALVIA VIRGATA* UNDER ELICITATION OF EXOGENOUS GABA**

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Pharmaceutical properties of *Salvia* plants (Labiatae) are mainly due to their secondary metabolites, especially phenolic compounds. For a long time, *Salvia* species have been used in traditional medicine and nowadays, these plants have attracted many attentions as novel natural treatments for the relief of many diseases such as depression, dementia, obesity, diabetes, heart disease, and cancers. The aim of this study was focused on the elicitation effects of  $\gamma$ -aminobutyric acid (GABA) on *PAL* gene expression and accumulation of three active phenolic compounds in the leaves of *Salvia virgata* Jacq. The mature seeds were sterilized and germinated in peat moss pots. Plantlets at six- leaf stage were treated with four concentrations (0, 0.01, 0.1 and 1  $\mu$ M) of aqueous solution of GABA. Leaf samples were harvested after 0, 12, 24 and 48 h treatment for RNA isolation. Total RNA was isolated from the leaf tissue samples using BIOZOL reagent, cDNA was generated using the iScript cDNA synthesis kit (BIO-RAD) and Real Time PCR was used to investigate the expression profiling of *PAL* in the samples. The methanolic extracts were analyzed by HPLC method and the concentration of rosmarinic acid (RA), salivianolic acid A (Sal A) and salivianolic acid B (Sal B) was measured in the samples using calibration equations. Real Time PCR analysis revealed that exogenous application of GABA led to up-regulation of *PAL* expression in the leaf samples, with the maximum value at 0.1  $\mu$ M concentration of GABA after 12 h of treatment. Data analysis also showed that in *S. virgata*, the greatest RA (106.3  $\mu$ g/g DW) and Sal B (433.1  $\mu$ g /g DW) accumulation was achieved at 0.01  $\mu$ M GABA, and the highest content of Sal A (8.2  $\mu$ g/g DW) was reported at 1  $\mu$ M of GABA, while the maximum gene expression of this enzyme was obtained at 0.1  $\mu$ M GABA. It was concluded that there was no statistically significant correlation between increase in transcription of *PAL* gene and the phenolic compounds accumulation in the studied samples. This is the first report on the effect of GABA as an elicitor on *PAL* enzyme in *S. virgata*. In conclusion, our findings indicated that *PAL* is not the only rate-determining enzyme in the biosynthesis pathway of phenolic compounds in *Salvia* species, and accumulation of these compounds could also be affected by some other factors [1].

**References**

[1] Ejtahed, Roghayeh Sadat.; Radjabian, Tayebeh; Hoseini Tafreshi, S. A. *Appl. Biochem. Biotechnol.* **2015**, *176*, 1846–1858.