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LC-MS determination of L-DOPA concentration in the leaf and flower tissues of six faba bean (*Vicia faba* L.) lines with common and rare flower colors

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ABSTRACT

Background: Parkinson's disease (PD) is the second most common neurodegenerative disorder characterized by the loss of muscle control, which causes trembling of the limbs and head as well as impaired balance. L-DOPA (L-3,4-dihydroxy phenylalanine) is the major ingredient of several prescription drugs used to treat PD. Faba bean (*Vicia faba* L.) is one of the few plant species that is known to produce L-DOPA and has the potential to be developed as a functional food crop for people suffering with PD.

Objective: Aimed to provide needed information for people who want to use faba bean as a natural remedy or functional food to relieve PD symptoms, this study analyzed the variation of L-DOPA concentration in the leaf and flower tissues of six faba bean lines with common and rare flower colors.

Methods: Leaf and flower samples were taken from field grown plants with different flower colors, namely, pink with purple lines and black dots, pure white, brown, and crimson. Samples were freeze-dried and L-DOPA was quantified by a LC-MS system consisting of an ACQUITY UPLC in line with a Synapt G2 HDMS quadrupole time-of-flight mass spectrometer. This experiment was carried out in two consecutive years (2012 and 2013) and the plants used in the second year were grown from the seeds harvested from the plants used in the first year.

Results and Discussion: Our two-year study revealed a high level of variation in L-DOPA concentration for leaf and flower tissues among the six faba bean lines studied. The average L-

DOPA concentration based on dry weight (DW) in flowers ranged from 27.8 to 63.5 mg/g and 18.2 to 48.7 mg/g for leaf tissues. There was no significant correlation between L-DOPA concentrations in flowers and leaves. The L-DOPA concentration in flowers and in leaves of the same line varied but was not statistically significant between the two years. Ideally, the genotype with the highest average L-DOPA concentration in both flowers and leaves would be grown as a natural source of this medicinally important molecule. When developing faba bean as a functional food crop for PD patients, a careful selection of genotype seems necessary for exploiting the full potential of this natural remedy.

Conclusions: Faba bean has the potential to be developed as a functional food crop for PD patients. Consumption of young pods and leaves is the most practical means for direct intake or processing of L-DOPA from the faba bean plant. Favorable environmental conditions for growth will optimize L-DOPA yield. Further analysis of the genetic control of L-DOPA synthesis and metabolism will be valuable, with the possibility of developing environmentally resilient cultivars that can produce desirable amounts of L-DOPA for pharmaceutical use.

Key words: Faba bean, L-DOPA, Parkinson's disease