The complexity of folate polyglutamylation in plants: Postharvest ripening and ethylene modulate polyglutamylated profiles in climacteric fruits plus systematic analysis of the glutamyl tail-editing enzymes

Sara M. Garza-Aguilar, Carolina García-Salinas, Paulina M. Mejía-Ponce, Cuauhtémoc Licona-Cassani, Perla A. Ramos-Parra and Rocío I. Díaz de la Garza

Scientia Horticulturae 273: 109588. (2020)

Abstract

Folate derivatives exist in nature in a variety of polyglutamyl forms (Glun); the glutamyl tail is added to the folate molecule by folylpolyglutamate synthetase (FPGS), and removed by gamma-glutamyl hydrolase (GGH) isoforms in several compartments within the cell. Folate polyglutamylation affects the use of the folate cofactors and their transport in organisms, also impacting their bioavailability as vitamins in mammals; however, little is known about its regulation in plants. We explored the possible effect of genetic, developmental, and environmental factors on the Glun extent of the most prevalent folate in plants, 5-CH_3-THF. We chose ripening and ethylene treatment in climacteric fruits, to assess developmental and environmental factors. Postharvest ripening increased short Glun tails, and ethylene gassing affected negatively long Glun tails. To evaluate genetic factors, we retrieved and compared the deduced FPGS and GGH sequences from 27 plants with known Glun profile and attempted to correlate their phylogenetic relation, number of isoforms, predicted localization, and primary sequence with the Glun profiles generated and gathered by this study. GGH sequences were quite conserved among plants, while FPGS diverged more. We postulate that the very long Glun tail found only in papaya is the result of very particular changes in one of the FPGS's primary structure.