L-Arginine treatment attenuates postharvest decay and maintains quality of strawberry fruit by promoting nitric oxide synthase pathway

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Abstract

In this study, the impacts of Arginine (Arg) on strawberry fruit quality and postharvest decay caused by fungi, as well as on the nitric oxide synthase (NOS) pathway of strawberry fruit, were considered. Strawberry fruits were first treated with 0, 0.5, 1, 5, and 10 mM Arg solution, and the result showed that treatment with 1 mM Arg was the best in inhibiting fruit decay and maintaining fruit quality, which is indicated by firmness, titratable acid, soluble solid content and respiration rate. To investigate the action mechanism of Arg and determine whether NOS is involved in the process, strawberry fruits were further treated with 1 mM Arg and 0.2 mM N^{ω}-nitro-*L*-arginine (*L*-NNA), a specific inhibitor of NOS, before storage at 20 ± 1 °C. In addition to reducing the decay incidence (DIC) and the decay index (DI), 1 mM Arg triggered NO accumulation, resulting from higher NOS activity, which is associated with a higher vitamin C, anthocyanin and total phenolic content, as well as the activities of the antioxidant enzymes - superoxide dismutase (SOD), catalase (CAT), peroxidase (POD) and ascorbate peroxidase (APX) - which are associated with a lower malondialdehyde (MDA) content. Moreover, the expression level of the pathogenesis-related protein1 (*FaPR1*) and the activities of the defense enzymes - phenylalanine ammonialyase (PAL), chitinase (CHI), β-1,3-glucanase (GLU) and polyphenol oxidase (PPO) – were higher in the Arg-treated fruits. However, such effects of 1 mM Arg treatment on strawberry fruits were almost reversed by the simultaneous addition of 0.2 mM *L*-NNA, leading to severer fruit decay. In addition, correlation analysis showed that Arg treatment significantly improved the correlation of NO with the activities of GLU (R^2 = 0.72*), CHI (R^2 = 0.85**), PAL (R^2 = 0.67*) and APX (R^2 = 0.72*). These findings indicated that Arg treatment might be a useful technique to improve quality and delay postharvest decay in strawberry fruit, and the NOS pathway played an important role in this process.