Exogenous phytosulfokine α (PSKα) application delays senescence and relieves decay in strawberry fruit during cold storage by triggering extracellular ATP signaling and improving ROS scavenging system activity

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Abstract

During postharvest life, strawberry fruit as a perishable commodity exhibiting short shelf life suffers from fungal decay that severely limits its marketability and nutritional value. Herein, we investigated the mechanisms activated by exogenous phytosulfokine α (PSKα) application at 150 nM to delay senescence and relieve decay in strawberry fruit during storage at 4 °C for 18 days. Our results showed higher extracellular adenosine triphosphate (ATP) accumulation arising from lower apyrase 1 (APY1) gene expression in strawberry fruit treated with 150 nM PSKα during storage at 4 °C for 6 days may serve as a signaling molecule to promote NADPH oxidase activity to trigger signaling H_2O_2 accumulation giving rise to higher SUMO E3 ligase (SIZ1) gene expression during 18 days of storage at 4 °C. Also, higher superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), and glutathione reductase (GR) genes expression and enzymes activity associated with higher methionine sulfoxide reductase (MSR) and peroxiredoxin (Prx) genes expression in strawberry fruit treated with 150 nM PSKα during storage at 4 °C for 18 days may be ascribed to extracellular ATP signaling. As a result, promoting ROS scavenging systems activity by triggering extracellular ATP signaling in strawberry fruit treated with 150 nM PSKα may be responsible for higher maintenance of membrane integrity as shown by lower malondialdehyde (MDA) accumulation during 18 days of storage at 4 °C. Besides, strawberry fruits treated with 150 nM PSKα exhibited lower weight loss, total soluble solids, and chroma value concurrent with higher firmness, titrable acidity, L* value, and hue angle as quality attributes, which indicated delayed fruit senescence. Based on our findings, exogenous PSKα application unveils its potential to be used as a promising signaling biopeptide for senescence delay and decay alleviation in strawberry fruit during its postharvest life.