Harnessing cGMP signaling pathways for improving fruits and vegetables marketability

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Abstract

During postharvest life, nitric oxide synthase/nitric oxide (NOS/NO) and phytosulfokine α/phytosulfokine receptor 1 (PSKα/PSKR1) systems activity promote cytosolic guanosine 3′, 5′-cyclic monophosphate (cGMP) accumulation in fruits and vegetables. Protein kinases G (PKGs), cyclic nucleotide-gated ion channels (CNGCs), and phosphodiesterases (PDEs) are responsible for cytosolic cGMP perception. Cytosolic cGMP signaling palliates chilling injury and fungal decay, delays senescence, and preserves sensory and nutritional quality in fruits and vegetables during postharvest life. By endogenous NOS/NO system activity, cytosolic cGMP signaling promotes cyclic ADP-ribose (cADPR) and inositol 1,4,5-trisphosphate ($InsP_3$) accumulation and activates serine/threonine (Ser/Thr) glycogen synthase kinase 3 (GSK3) and mitogen-activated protein kinase (MAPK) protein kinases. In addition to NOS/NO system activity, PSKα/PSKR1 system activity triggers cytosolic cGMP accumulation. Cytosolic Ca^{2+} signaling could improve fruits and vegetables marketability by harmonizes intracellular SNF1 (sucrose non-fermenting 1)-related protein kinase 1 (SnRK1) and extracellular ATP signaling pathways, intracellular SUMO E3 ligase (SIZ1), arginase/NOS (ARG/NOS), and poly(ADP-Ribose) polymerase 1 (PARP1) systems activity. Elucidating molecular mechanisms employed by cytosolic cGMP signaling have intrinsic scientific worth with noteworthy translational prospects and can supply novel knowledge beneficial for improving fruits and vegetables marketability.