Effect of cutting on the reactive oxygen species accumulation and energy change in postharvest melon fruit during storage

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Abstract

The effect of cutting on the accumulation of reactive oxygen species (ROS) and energy change in melon fruit (cv. Xizhoumi-17, stored at 15 °C) during storage was explored. The key metabolites, enzymes, and genes involved in ROS accumulation and energy metabolism were investigated. Cutting melon fruit changed the respiratory metabolism pathway, increased the respiration rate, and maintained higher activities of H^+-adenosine triphosphatase and Ca^{2+}-adenosine triphosphatase. This led to the large generation of adenosine triphosphate, adenosine diphosphate, NADPH, and NADH in fresh-cut melon fruit. Furthermore, cutting enhanced the NADPH oxidase activity, which induced a higher ROS level and further resulted in higher malondialdehyde content and electrolyte leakage. However, only the activities of peroxidase (POD) and glutathione peroxidase (GPX) were enhanced in fresh-cut melon during the early stage of storage. In addition, lower antioxidant system activity was observed in fresh-cut melon at the late stage of storage. This was indicated by the lower levels of ascorbic acid, glutathione, POD, GPX, ascorbate peroxidase, and glutathione reductase. These lower levels were related to changes of genes related to ROS accumulation and energy metabolism in fresh-cut melon. These findings demonstrate that cut-wounding stress changed the respiratory metabolism pathway in melon fruit and led to a higher energy status, accompanied by increased ROS accumulation.