Study explores ATP's role in postharvest chilling tolerance of fruits

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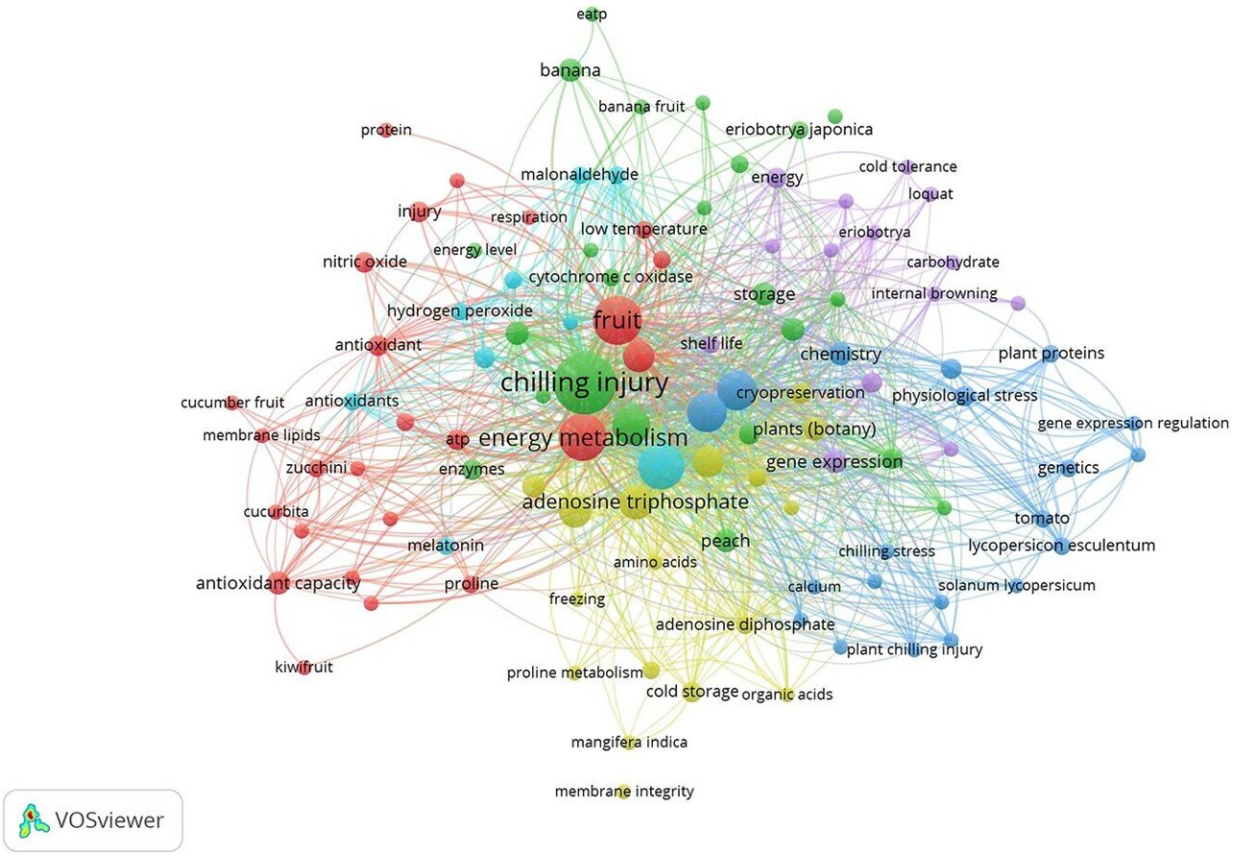

The VOS viewer software-based network visualization of keyword co-occurrence in extracted peer-reviewed scientific papers related to ATP regulation in postharvest chilling tolerance in fruits from Scopus database. The connecting lines between phrases show co-occurrences in the same article, and the keywords contained in the same cluster reveal that they have been analyzed frequently in the same publications. Credit: *Horticulture Research* (2024). DOI: 10.1093/hr/uhae204

Postharvest chilling injury (PCI) is a major challenge in the horticulture industry, resulting in significant losses due to the perishable nature of fruits when stored at low temperatures. Chilling stress disrupts cellular homeostasis, induces oxidative damage, and alters membrane protein structures, which in turn hampers electron transport and adenosine triphosphate (ATP) production.

Despite ongoing efforts to mitigate PCI, the mechanisms behind this injury remain incompletely understood, prompting a need for deeper research into the biochemical and physiological responses of fruits under chilling conditions.

On July 26, 2024, researchers from the National Institute of Food Technology Entrepreneurship and Management published a comprehensive review in *Horticulture Research*, focusing on ATP's role as a signaling regulator in postharvest chilling tolerance of fruits. The study critically examines the key pathways involved in ATP supply, underscoring their significance in maintaining membrane integrity under chilling stress.

This review delves into the complex functions of ATP in fruit physiology, with a particular focus on its regulation of chilling tolerance postharvest. Key metabolic pathways such as the Embden–Meyerhof–Parnas pathway, the tricarboxylic acid cycle, and the pentose phosphate pathway are identified as major contributors to ATP production, which is essential for energy metabolism and stress response in fruits.

The study explores how ATP's intracellular and extracellular forms interact to mediate chilling stress, highlighting the γ-aminobutyric acid shunt pathway and the cytochrome pathway as important players in ATP

generation. Notably, the research also discusses the potential of nicotinamide adenine dinucleotide (NAD+) in mitigating PCI and the signaling role of extracellular ATP through its receptor DORN1, which triggers protective responses against oxidative damage. These findings deepen our understanding of fruit stress tolerance and pave the way for targeted postharvest treatments to preserve fruit quality.

Dr. Sunil Pareek, lead author of the study, emphasizes, "Our review underscores the pivotal role of ATP in postharvest fruit management. By understanding ATP's regulatory mechanisms, we could revolutionize the preservation of fruit quality, especially in cold storage, which is crucial for global trade and food security."

The findings of this study hold significant promise for the horticulture industry. By developing novel treatments to enhance chilling tolerance, this research could reduce food waste, extend shelf life, and improve the nutritional value of fruits for consumers worldwide. Moreover, the study opens new avenues for exploring the intricate relationship between ATP metabolism and chilling stress in horticultural produce, potentially leading to more sustainable practices in fruit preservation.

More information: Hansika Sati et al, Is ATP a signaling regulator for postharvest chilling tolerance in fruits?, *Horticulture Research* (2024). DOI: 10.1093/hr/uhae204

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