INTERNATIONAL SUMMIT ON DIABETES, ENDOCRINOLOGY, AND METABOLIC DISORDERS

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Multiomics Research on Anti-diabetic Effects of Acylated and Non-acylated Anthocyanins

Abstract

Anthocyanins have been shown to possess anti-diabetic properties. Anthocyanins from different sources vary in both the structural features of aglycons and sugar moieties, but also in the presence of acyl groups. Acylated anthocyanins are known to have higher stability compared to their nonacylated counterparts. Research data is scanty comparing the metabolic impacts of these two types of anthocyanins. To fill the knowledge gap, two clinical intervention studies were carried out to study the effects of acylated anthocyanins of purple potatoes and non-acylated anthocyanins of bilberries on postprandial glycemic responses in healthy male volunteers. Purple potatoes and anthocyanin extracts from purple potatoes decreased the postprandial glycemic response after a heavy carbohydrate meal. To further explore the mechanism in the metabolic pathways, an eight-week preclinical feeding trial was performed to study impact of these two types of anthocyanins on the metabolomics profiles as well as gut microbiota of obese diabetic Zucker rats. Treatment with acylated anthocyanins or non-acylated anthocyanins decreased levels of branch chain amino acids (BCAAs) and improved lipid profiles. Acylated anthocyanins increased glutamine/glutamate ratio in plasma, suggesting improved insulin secretion and insulin sensitivity.

ISBN: 978-1-917892-09-4

doi.org/10.51219/URForum.2025.Baoru-Yang

Acylated anthocyanins decreased levels of lactate, serine, threonine, and glycine, which might be associated with improved oxidative status and shift in energy production from glycolysis and TCA cycle towards lipid catabolism. Our data demonstrated that acylated anthocyanins reversed most of the altered levels of metabolites in diabetic rats towards the normal state by modifying insulin sensitivity and secretion, oxidative stress, energy production, and lipid profiles. Furthermore, the two types of anthocyanins showed differential impacts on the hepatic transcriptomics, gut metabolomics profile, and gut microbiota of diabetic rats, which likely contributed the observed metabolic outcomes.

Keywords: Acylated anthocyanins, non-acylated anthocyanins, anti-diabetic effects, multi-omics research

Biography

Professor Baoru Yang is the Director of Food Sciences and the Vice Dean of the Faculty of Technology, University of Turku. She is a member of the Finnish Academy of Science and Letters. Professor Yang's research is in the field of Food Chemistry and Food Development, with special focus on the composition and health effects of food with special focus on polyphenols and lipids. She has published over 300 peer-reviewed papers.

ISBN: 978-1-917892-09-4