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Ferulic acid ameliorates oxidative stress, endothelial dysfunction and vascular remodeling in high-carbohydrate and high-fat diet fed rats

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Statement of Problem: Chronic intake of high-carbohydrate and high-fat (HCHF) diet causes metabolic abnormalities, including insulin resistance, dyslipidemia and hypertension. Decreased nitric oxide (NO) bioavailability and increased angiotensin II signaling are implicated in the pathogenesis of endothelial dysfunction and hypertension by accelerating the formation of reactive oxygen species. Therefore, current nutritional advice emphasizes the benefits of fruit and vegetable consumption. Ferulic acid (FA) is a major phenolic compound found in rice oil, cereals and various types of fruits and vegetables. This study was designed to test whether FA supplementation could reduce oxidative stress, endothelial dysfunction and vascular remodeling in rats fed a HCHF diet.

Methodology & Theoretical Orientation: Male Sprague- Dawley rats were fed either a standard chow diet and tap water or a HCHF diet with 15% fructose solution for 16 weeks. HCHF rats were treated orally with FA (30 and 60 mg/kg/day) for the final 6 weeks of the experimental period. At the end of the experiment, hemodynamic status, vascular functional and structural changes, oxidative stress markers, angiotensin-converting enzyme (ACE) activity and angiotensin II type 1 receptor (AT1R) expression were measured.

Findings: FA reduced oxidative stress via suppressing $p47^{phox}$ NADPH oxidase and increasing eNOS expression. FA decreased arterial blood pressure, reduced aortic stiffening and improved endothelial dysfunction by increasing the endothelium-dependent vasodilator responses. Moreover, FA reduced HCHF diet-induced hypertrophic remodeling of the aortic wall and decreased matrix metalloproteinase-2 (MMP-2) and MMP-9 expression. The ameliorative effects of FA were associated with a reduction of ACE activity and downregulation of AT1R, indicating that FA could inhibit the renin-angiotensin system.

Conclusion & Significance: Overall findings suggest the beneficial effect of FA on preventing vascular complications in metabolic syndrome.

Biography

Ketmanee Senaphan has done her DVM from Khon Kaen University, Thailand in the year 2011. She has completed her PhD in Medical Physiology from Khon Kaen University, Thailand, 2016. She has received a Scholarship i.e., The Royal Golden Jubilee PhD Program, the Thailand Research Fund. Her research interests are Endothelial dysfunction, arterial stiffening and vascular remodeling in animal models of metabolic syndrome, diabetes and hypertension, with special focus on many dietary antioxidants in improvement of cardiovascular function and reduction of cardiovascular risk.

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