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Differential Proteomics Expression in Purple Rice Supplemented Type 2 Diabetic Rats' Skeletal Muscle

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Abstract : Type 2 diabetes is one of the most common metabolic diseases all over the world. The pathogenesis of type 2 diabetes is not the only dysfunction of pancreatic beta cells but also insulin resistance in muscle, liver and adipose tissue. High levels of circulating free fatty acids, an increased lipid content of muscle cells, impaired insulin-mediated glucose uptake and diminished mitochondrial functioning are pathophysiological hallmarks of diabetic skeletal muscles. Purple rice (Oryza sativa L. indica) has been shown to have antidiabetic effects. However, the underlying mechanism(s) of antidiabetic activity of purple rice is still unraveled. In this research, to explore in-depth cellular mechanism(s), proteomic profile of purple rice supplemented type 2 diabetic rats' skeletal muscle were analyzed contract with non-supplemented rats. Diabetic rats were induced high-fat diet combined with streptozotocin injection. By using one- dimensional gel electrophoresis (1-DE) and LC-MS/MS quantitative proteomic method, we analyzed proteomic profiles in skeletal muscle of normal rats, normal rats with purple rice supplementation, type 2 diabetic rats, and type 2 diabetic rats with purple rice supplementation. Total 2676 polypeptide expressions were identified. Among them, 24 peptides were only expressed in type 2 diabetic rats, and 24 peptides were unique peptides in type 2 diabetic rats with purple rice supplementation. Acetyl CoA carboxylase 1 (ACACA) found as unique protein in type 2 diabetic rats which is the major enzyme in lipid synthesis and metabolism. Interestingly, DNA damage response protein, heterogeneous nuclear ribonucleoprotein K [Mus musculus] (Hnrnpk), was upregulated in type 2 diabetic rats' skeletal muscle. Meanwhile, unique proteins of type 2 diabetic rats with purple rice supplementation (bone morphogenetic 7 protein preproprotein, BMP7; and forkhead box protein NX4, Foxn4) involved with muscle cells growth through the regulation of TGF-β/Smad signaling network. Moreover, BMP7 may effect on insulin signaling through the downstream signaling of protein kinase B (Akt) which acts in protein synthesis, glucose uptake, and glycogen synthesis. In conclusion, our study supports that type 2 diabetes impairs muscular lipid metabolism. In addition, purple rice might recover the muscle cells growth and insulin signaling.

Keywords : proteomics, purple rice bran, skeletal muscle, type 2 diabetic rats
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