

Biological functions of phenethyl isothiocyanate for glucose and lipid metabolisms

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Phenethyl isothiocyanate (PEITC), a natural dietary isothiocyanate, has been shown to have beneficial effects in improving cellular defense activities against oxidative stress through activation of nuclear factor erythroid-2 related factor 2 (Nrf2) pathway. However, little evidence exists if the antioxidative activity has beneficial effects on glucose metabolism. Here, we examined the preventive potential of PEITC for impaired insulin induced glucose uptake by oxidative stress in 3T3-L1 adipocytes. Treatment with PEITC increased the expression of antioxidative enzymes regulated by Nrf2 such as γ -glutamylcysteine-synthetase, heme oxygenase 1, NAD(P)H:quinone oxidoreductase 1 and glutathione S-transferase, and reduced oxidative stress induced by H₂O₂. Furthermore, PEITC restored impaired insulin-stimulated glucose uptake, translocation of glucose transporter 4 (Glut4) and insulin signaling by H₂O₂. These results indicate that PEITC protected insulin-regulated glucose metabolism impaired by oxidative stress through the antioxidative activity in 3T3-L1 adipocytes. Next, we tested whether PEITC directly promotes glucose utilization in mouse skeletal muscle cells, C2C12 myotubes. PEITC induced glucose uptake, Glut4 translocation to the plasma membrane, and activation of Akt and ERK in C2C12 cells. Inhibition of Akt suppressed PEITC induced Glut4 translocation and glucose uptake, whereas ERK inhibition did not. These results indicate that PEITC promotes glucose utilization through Akt pathway in C2C12 myotubes. Taken together, PEITC may serve as a dietary constituent with beneficial effects on the carbohydrate metabolism.