Monoterpenes: Novel insights into their biological effects and roles on glucose uptake and lipid metabolism in 3T3-L1 adipocytes

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ABSTRACT
Various strategies have been adopted to combat complications caused by Type 2 diabetes mellitus and controlled diet is one of them. Monoterpenes, major constituents of essential oils, are synthesized and widely used as artificial food flavors. A series of twelve monoterpenes were assessed in the present study. Monoterpenes, exhibited low 2,2-diphenyl-2-picrylhydrazyl hydrate (DPPH) and 2,2'-azinobis-(3-ethyl benzothiazoline-6-sulfonic acid) (ABTS) radical scavenging activity even at high concentrations. Some monoterpenes inhibited α-amylase and α-glucosidase activity and stimulated glucose uptake and lipolysis. Monoterpenes such as (R)-(+)-limonene stimulated both glucose uptake (17.4%) and lipolysis (17.7%); the mRNA expression of glucose transporter 1 (GLUT1) was upregulated but glucose transporter 4 (GLUT4) was unaffected, and adipose triglyceride lipase (ATGL) was suppressed. Taken together, the selected monoterpenes may not confer strong protection against free radicals but nevertheless, their positive influence on lipid and glucose metabolism may have potential in the control of obesity and Type 2 diabetes mellitus.