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Regulation of lipid metabolism with *Plantago asiatica* essential oil and its major compound, linalool

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Plantago asiatica essential oil (PAEO) is bioactive with linalool as a major compound (82.5%, w/w) quantified GC-MS analysis. Stimulation of HepG2 cells with PAEO altered the expression of LDL receptor and HMG-CoA reductase (HMGCR), and inhibited LDL oxidation thus reduced cellular cholesterol accumulation. Oral administration of PAEO for 3 weeks in C57BL/6 mice reduced LDL cholesterol and triglyceride concentrations, and downregulated mRNA and protein levels of HMGCR. In mice, oral administration of linalool, a major compound in PAEO, to mice lowered total and LDL cholesterol concentrations. Linalool reduced HMGCR protein expression by lowering the binding of SREBP-2 to its promoter and by inducing ubiquitin-dependent proteolysis of HMGCR to show hypocholesterolemic activities. In addition, reporter gene and time-resolved fluorescence resonance energy transfer assays indicated linalool is a direct ligand of PPAR α . Linalool reduced cellular lipid accumulation by regulating PPAR α -responsive genes and inducing fatty acid oxidation, whereas silencing PPAR α expression attenuated its effects. In mice, oral administration of linalool for 3 weeks reduced plasma triglyceride concentrations in Western diet-fed C57BL/6J mice and ApoE2 mice, and regulated hepatic PPAR α target genes, whereas these effects were abolished in PPAR α -deficient mice. Transcriptome profiling revealed that linalool (1 mM) stimulation rewired global gene expression in lipid-loaded hepatocytes comparable to those of fenofibrate (0.1 mM). Metabolomic analysis of mouse plasma showed distinguishable global metabolite profiles between linalool-fed mice and controls. Collectively, these findings suggest that the appropriate intake of PAEO could exert beneficial metabolic effects by regulating a cellular nutrient sensor.

Biography

Sung-Joon Lee completed BA and MA from Seoul National University in the Department of Food Science and Technology and obtained PhD at Harvard University in the Department of Nutrition. After postdoctoral fellowship at Stanford University, then started his own laboratory at Korea University in 2004. He is now a professor in the Department of Biotechnology at Korea University. His main research topics include investigation of biological activity and mechanism of phytochemicals in the lipid metabolism and other lipid metabolism related symptoms. He has published more than 100 papers in peer-reviewed journals and has written two textbooks.

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