

Anti-diabetic and anti-obesity effects of *Zingiber officinale* Roscoe rhizome extract and its constituents

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The potential roles of *Zingiber officinale* Roscoe (Ginger) for treating and preventing the complications of diabetes have been investigated in both humans and experimental animals. Since our final goal is to develop dietary supplements using novel functional plant foods with potent anti-diabetic and anti-obese activity of desirable characteristics, in this research we aim to further investigate molecular mechanism effects of ginger in detail on glucose uptake, adipogenesis and lipolysis using L6 myotubes and 3T3-L1 adipocytes cultured model. Ginger extract and its main constituent; 6-gingerol showed dose and time dependent manners on glucose uptake effects in both L6 myotubes and 3T3-L1 adipocytes. The enhancement of glucose transport by ginger was mediated by the activation of GLUT4 translocation via both phosphatidylinositol 3-kinase (PI3 Kinase) and 5'-AMP-activated kinase (AMPK) activation. Additionally, GLUT1 and GLUT4 upregulation was modulated through the extracellular signal regulated kinase (ERK1/2) and the protein kinase mTOR (mammalian target of rapamycin) pathways. For anti-obesity effect study, ginger extract and its main ingredient; 6-gingerol inhibits fat accumulation in 3T3-L1 adipocytes. However, the expression of genes involved in lipid metabolism, transcription factors peroxisome proliferators-activated receptor- γ (PPAR γ) and CCAAT/enhancer binding protein (C/EBP α) were not altered following ginger treatment. In conclusion, our study suggests that ginger exerts its anti-diabetic activity via the enhancement of peripheral glucose utilization by muscle and fat tissue. In addition, ginger shows anti-obesity effect but needs further investigation.

Key words: *Zingiber officinale*, L6 myotubes, 3T3-L1 adipocyte, glucose uptake, adipogenesis

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