

Effect of Ginsenoside Rb1 on Glucose Uptake and Expression of Glucose Transporters in Animal Cells

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RUNNING TITLE: ginsenoside stimulate glucose uptake

FOOTNOTE:

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ABSTRACT

Ginsenosides are major components of ginseng and are attributed for most of its pharmacological activities. Despite extensive studies, the mechanism of action of ginseng remains to be clarified. In an effort to elucidate the mechanism of the prominent gluco-regulatory activity of ginseng, in this study, we measured the effect of ginsenoside Rb1 on glucose uptake in different cell systems including intestinal, adipocytes, and skeletal muscle myotubes. At submicromolar concentrations, Rb1 inhibited the rate of glucose transport across the differentiated Caco-2 cell monolayer to about 67% of the original rate. Consistent with the effect on glucose uptake rate, Rb1 conferred a significant and paralleled alteration on both the protein and mRNA expression levels of the Na⁺/glucose cotransporter 1 (SGLT1) gene. In contrast to the intestinal cells, Rb1 exerted a stimulus effect on glucose uptake of the 3T3-L1 adipocytes and skeletal muscle myotubes. Western blot analysis revealed that Rb1 also enhanced GLUT4 expression in these cells. Further studies demonstrated that the stimulus effect of Rb1 on glucose uptake might be associated with the activation of AMP-dependent protein kinase (AMPK), which is one of the key pathways in mediating glucose uptake in insulin-independent manner. In summary, we demonstrated the Rb1 inhibited glucose uptake in intestinal cells while enhance the insulin-independent manner in adipocytes and skeletal muscle myotubes. These findings are important in understanding the hypoglycemic properties and potential applications of ginseng and ginsenosides.

Keywords: ginsenoside, Na⁺/glucose cotransporter, GLUT4, Caco-2 cells, 3T3-L1 adipocytes, skeletal muscle myotubes

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