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The Effect of Ginsenosides on mRNA Expression of Leptin and Other Genes Related to Lipid Metabolism in 3T3L1 Adipocytes Cultured Under Enriched Lipid Conditions

Eunju Kim, Hyunil Lee, Shinsuk Kang, Youngtae Ro, Yunhee Noh and Ja-Hyun Koo
Department of Biochemistry, College of Medicine, Konkuk University, Chungju 380-701

Obesity, a rapidly expanding nutritional disorder in modern society, is associated with serious comorbidities, including a high incidence of type II diabetes, cardiovascular disease, osteoarthritis, and an increased risk of many cancers.[1] Changes in body weight are resulted from the difference between energy intake and expenditure. Several modulations are known to regulate these energy intake and energy expenditure.

Ginsenosides are the components of saponins extracted from ginseng and they are known to possess various physiological and pharmacological activities. One of these activities is related to decreased lipid levels in plasma.[2]

In this study, the effect of ginsenosides on fat metabolism was examined in 3T3-L1 adipocytes cultured in high fatty acid conditions. The amounts of triglyceride (TG) in the 3T3-L1 adipocytes cultured in high fatty acid conditions were greatly increased in a dose-dependent manner, compared to a control condition without fatty acid. All the ginsenosides tested including Rh2 and compound K relieved this TG increment in high fatty acid conditions back to the control level, suggesting that ginsenosides have a lowering effect of TG level in adipocytes.

Leptin, a circulating hormone secreted mainly from adipocyte tissue, has been known for lowering TG content in adipocyte by transcriptional activations of the crucial genes involved in peroximal and mitochondiral β-oxidation.[3] The mitochondrial uncoupling protein (UCP) is also responsible for the thermogenic function of fat.[4] Therefore, we tested whether the effects of ginsenosides on lowering TG level in adipocytes are related to transcriptional regulations of leptin and UCP2 genes. The results showed that ginsenosides, especially Rh2 and compound K, enhanced the transcription of both leptin and UCP2 mRNA, indicating that the decreased TG level in 3T3-L1 adipocytes by gisenosides is closely related to the up-regulation of leptin and UCP mRNA expressions.

Sterol regulatory element binding proteins (SREBPs) are a family of transcription factors that regulate multiple enzymes required for the biosynthesis of cholesterol and fatty acids.[5] Our result also showed that ginsenosides enhanced the SREBP and fatty acid synthase (FAS) mRNA transcriptions of the adipocytes, suggesting that lipid metabolism in adipocytes is also related to a differentiation process related with SREBP transcriptional activation.

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구자현
tel : 043-840-3737
fax : 043-851-3944
(380-701) 충북 충주시 단월동 건국의대 생화학교실,
jhkoo@kku.edu

김은주
tel : 043-840-3736
fax : 043-851-3944
(380-701) 충북 충주시 단월동 건국의대 생화학교실,
marinebl@dreamwiz.com