

## Anti-Stress Effect of Korean Red Ginseng on Immobilization-Stressed Mice

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Stress can be defined as physical and psychological modifications that disrupt the homeostasis and balance of organisms. Immobilization (IMO) stress has been reported to impair motor activity, cause memory dysfunction, modulated anxiety, pain perception and depression-like behaviors in the animals. Many of these effects are thought to be mediated by stress-induced neurochemical and hormonal abnormalities that are often associated with oxidative damage. Korean red ginseng (KRG) is frequently used as an anti-stress agent. To investigate the effect of KRG on IMO stressed mice, myeloperoxidase (MPO) activity, levels of malondialdehyde (MDA) and protein carbonylation, and gene expressions were determined. Although MPO activity, MDA and protein carbonylation levels were all increased in IMO stressed mice, after KRG administration, they were decreased. To examine expression of genes in IMO stressed mice after administration of KRG, microarray analysis was performed using oligonucleotide chips with 25,000 genes. Compared with the non-stressed group, 104 genes were up-regulated and 64 down-regulated. However, KRG pretreatment repressed up-regulation of 21 genes including Padi4, Hoxa5, Rapgef5, Atg31, and Slc4a1. Repression of several genes by KRG was further confirmed by reverse transcriptase-PCR. These results suggest that KRG can modulate genes expression involved in oxidative stress as well as apoptosis/autophagy.