

## **Korean ginseng (*Panax ginseng* C.A. Meyer) helps to recover fatigue.**

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Historically, Korean ginseng (*Panax ginseng* C.A. Meyer) has been known as one of the most precious herbal medicines in Korea, China and Japan for more than 2000 years. Single ginseng or combination with other botanicals has been prescribed to treat various diseases or to counterbalance weak vitality. Recently, European Union and WHO approved Korean ginseng as a tonic medicine. Ginseng glycosides (ginsenosides), polysaccharides, phenolic compounds, alkaloids, peptides, and polyacetylenes have been found to be the active ingredients of Korean ginseng. However, ginsenosides are regarded as the main active ingredients of ginseng.

Recently we have reported that IH-901, a human intestinal microbial metabolite of protopanaxadiol ginsenosides, demonstrated more potent activities than the naturally occurring ginsenosides: antitumorigenic and antidiabetic effects. In the present study, we carried out animal and clinical studies to elucidate the antifatigue effect of IH-901 by monitoring blood chemistry panels associated with free radical oxidation. During exercise, oxygen utilization and electron flow through electron transfer system spontaneously increases and 2~3% of the inhaled oxygen is converted to superoxides, a highly reactive free radicals, thus leading to fatigue and further to varied diseases unless properly controlled.

Seven healthy male (age  $21 \pm 2.11$ ) subjects were exposed to treadmill exercises to exhaustion before and after ginseng treatment (2 g, 3 times a day) for 8 weeks. An array of panels related to free radical oxidation was determined immediately after, and 10 and 30 minutes after maximum exercise loading. Maximum oxygen intake and the maximum heart rate were significantly decreased in ginseng treated group. Superoxide dismutase (SOD) and catalase (CAT) activities, total anti-oxidant status (TAS), and all-out time were significantly increased by ginseng. These results demonstrate that Korean ginseng suppresses increase of free radical oxidation in human during exercise by elevating the amount or activity of enzymes associated with anti-oxidation, which in turn help our body recover from fatigue.

Further study was performed to elucidate antifatigue and antioxidative effect of IH-901 in rats (male, Sprague Dawley,  $250 \pm 10$  g). A total of sixty four male rats (4-month-old, Sprague-Dawley) were largely divided into 2 equal groups: untrained and trained groups.

Each group was further divided into 4 subgroups: control, IH-901 low dose (25 mg/kg b.w.), mid-dose (50 mg/kg b.w.), and high dose (100 mg/kg, b.w.). Rats were trained beforehand to do compulsive exercise and exposed to the enforced running at the speed of 35 cm/sec for 30 minutes, 3 times a week. At week 7, the rats were subjected to water maze pool test. Biological activities and maximum exercise ability were determined at week 4 and 8. What is more, serum biochemical parameters, organ weight and activities of enzymes related to oxidation in muscle and lung tissue were also measured.

Enzyme activities of xanthine oxidase (XO) and myeloperoxidase (MPO), and the production of free radicals were found to be inhibited. Furthermore, oxidation reaction metabolites, such as MDA and protein carbonyl were also inhibited and damage by radicals was markedly alleviated. Elevated level of creatine kinase (CK) and lactate dehydrogenase (LDH) activities in the blood were decreased in IH-901 treated group. IH-901 also increased activities of glutathione peroxidase (GPx), glutathione S-transferase (GST) and SOD, thereby eliminating free radicals more effectively. Extension of maximum exercise duration induced by IH-901 can be attributed to the decrease in tissue damage induced by the free radicals.

In conclusion, Korean ginseng and IH-901, the human intestinal bacterial metabolite of ginsenoside, apparently show antifatigue and antioxidative effect by suppressing hyperoxidation in body during exercise and increasing enzyme activities related to free radical oxidation, thus led longer physical endurance.