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Chemopreventive and Chemoprotective Effects of *Panax Ginseng* C.A. Meyer and Its Constituents

Young-Joon Surh

College of Pharmacy, Seoul National University, Seoul 151-742, Korea

In recent years, there have been considerable efforts to search for naturally occurring substances that can inhibit, reverse, or retard the multi-stage carcinogenesis. A wide array of phenolic substances derived from edible and medicinal plants have been reported to possess anticarcinogenic and antimutagenic activities and in many cases, the chemopreventive activities of phytochemicals are associated with their anti-inflammatory and/or antioxidative properties. *Panax ginseng* C.A. Meyer has been widely used in traditional herbal medicine for the treatment of various diseases. Certain fractions or purified ingredients of ginseng have been shown to exert anticarcinogenic and antimutagenic activities. Our previous studies have revealed that the methanol extract of heat-processed *Panax ginseng* attenuates the lipid peroxidation in rat brain homogenates and is also capable of scavenging superoxide generated by xanthine-xanthine oxidase or by 12-*O*-tetradecanoylphorbol-13-acetate (TPA) in differentiated human promyelocytic leukemia (HL-60) cells. Topical application of the same extract onto shaven backs of female ICR mice suppressed TPA-induced skin tumor promotion. Likewise, topical application of ginsenoside Rg3, one of the constituents of heat-treated ginseng, significantly inhibited TPA-induced murine epidermal ODC activity andskin tumor promotion. Expression of cyclooxygenase-2 (COX-2) and inducible nitric oxide synthase (iNOS) in TPA-stimulated mouse skin was markedly suppressed by Rg3 pretreatment. In addition, Rg3 inhibited activation of NF-kappa B and AP-1 transcription factors in mouse skin as well as in cultured human promyelocytic leukemia cells. Similarly, an intestinal bacterial metabolic derivative formed from protopanaxadiol saponin of *Panax ginseng* exhibited anti-inflammatory and anti-tumor promotional activities. Some minor ginsenosides present in Korean red ginseng blocked the TPA-induced activation of mitogen-activated protein kinases such as p38 and ERK. Red ginseng also has some protective effects against PCB-induced oxidative cell death.