

## PROTECTIVE EFFECT OF RED GINSENG EXTRACT AGAINST PCB-INDUCED OXIDATIVE CELL DEATH

Jung-Hee Jang, Chu-Yue Chen and Young-Joon Surh

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

(장정희, 천추웨, 서영준, 서울대학교 약학대학 생화학실)

Polychlorinated biphenyls (PCBs) are ubiquitous environmental contaminants that display a complex spectrum of biological and toxicological properties including cognitive and motor dysfunctions. There has been compelling evidence supporting that PCB-induced cytotoxicity is mediated through generation of reactive oxygen (ROS). Considerable attention has recently been focused on identifying naturally occurring phytochemicals that are able to scavenge excess ROS, thereby protecting against oxidative cell death. Red ginseng, which has a variety of biological and pharmacological activities including antioxidant, anti-inflammatory, antimutagenic and anticarcinogenic effects, has been widely used in traditional herbal medicine for the treatment of various disease. In this study, we have investigated the effect of red ginseng extract on PCB126-induced oxidative cell death in cultured rat pheochromocytoma (PC12) cells. PC12 cells treated with PCB126 exhibited increased accumulation of intracellular ROS and underwent apoptotic death as determined by characteristic morphological alterations and positive *in situ* terminal end-labeling (TUNEL staining). PCB126 treatment also led to the perturbation of mitochondrial membrane potential. Red ginseng extract attenuated PCB126-induced cytotoxicity, apoptotic features, and intracellular ROS accumulation. In another experiment, red ginseng extract caused an elevated level of cellular glutathione. These results suggest that red ginseng extract could modulate oxidative neuronal cell death caused by PCB126, and may have preventive or therapeutic potential in the management of neurotoxic damage caused by environmental contaminants..

Key words : apoptosis, PCB126, PC12 cells, reactive oxygen species, red ginseng extract

## References

1. Mariussen E, Myhre O, Reistad T, Fonnum F. The polychlorinated biphenyl mixture aroclor 1254 induces death of rat cerebellar granule cells: the involvement of the N-methyl-D-aspartate receptor and reactive oxygen species. *Toxicol Appl Pharmacol.*, 179:137-44 (2002).
2. Jin X, Kennedy SW, Di Muccio T, Moon TW. Role of oxidative stress and antioxidant defense in 3,3',4,4',5-pentachlorobiphenyl-induced toxicity and species-differential sensitivity in chicken and duck embryos. *Toxicol Appl Pharmacol.*, 172:241-8 (2001).
3. Sanchez-Alonso JA, Lopez-Aparicio P, Recio MN, Perez-Albarsanz MA. Apoptosis-mediated neurotoxic potential of a planar (PCB 77) and a nonplanar (PCB 153) polychlorinated biphenyl congeners in neuronal cell cultures. *Toxicol Lett.*, 144:337-49 (2003).
4. Keum YS, Han SS, Chun KS, Park KK, Park JH, Lee SK, Surh YJ. Inhibitory effects of the ginsenoside Rg3 on phorbol ester-induced cyclooxygenase-2 expression, NF-kappaB activation and tumor promotion. *Mutat Res.*, 523-524:75-85 (2003).
5. Surh YJ, Lee JY, Choi KJ, Ko SR. Effects of selected ginsenosides on phorbol ester-induced expression of cyclooxygenase-2 and activation of NF-kappaB and ERK1/2 in mouse skin. *Ann N Y Acad Sci.*, 973:396-401 (2002).
6. Surh YJ, Na HK, Lee JY, Keum YS. Molecular mechanisms underlying anti-tumor promoting activities of heat-processed Panax ginseng C.A. Meyer. *J Korean Med Sci.*, 16, Suppl:S38-41 (2001).
7. Keum YS, Park KK, Lee JM, Chun KS, Park JH, Lee SK, Kwon H, Surh YJ. Antioxidant and anti-tumor promoting activities of the methanol extract of heat-

processed ginseng. *Cancer Lett.*, 150:41-8 (2000).

Phone: 02- 880-7845;

Fax: 02-874-9775

E-mail: [surh@plaza.snu.ac.kr](mailto:surh@plaza.snu.ac.kr)

[pamy@snu.ac.kr](mailto:pamy@snu.ac.kr)

본 과제는 한국인삼공사에서 지원한 연구비와 시료에 의거 수행하였음.