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## Differential Regulation of Th1/Th2 Cytokine Production by Curcumin

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Curcumin, a principal ingredient of turmeric (*Curcuma longa*), has been reported to have anti-tumor, anti-inflammatory, antioxidant, and prooxidant properties. All these pharmacological properties are quite related with the functions of immune organs. Therefore, present study was performed to investigate the effect of curcumin treatment on the immune functions, especially cytokine productions. Curcumin treatment significantly and dose-dependently decreased the B-cell and T-cell proliferation induced by LPS or Con A, respectively. Production of Th1 cytokines such as IL-2, IFN- $\gamma$ , and TNF- $\alpha$  were well induced by Con A stimulation while Th2 cytokines including IL-4 and IL-5 showed minimal induction levels. Curcumin treatment depressed dose-dependently the production of Th1 cytokines measured at 24 hrs in the supernatant of splenocyte cultures. In addition, the depression was highly sensitive showing decrease by 33 (IL-2), 51 (IFN- $\gamma$ ), and 26% (TNF- $\alpha$ ) at 1.5  $\mu$ M of curcumin. The decreased levels of IL-2 in a curcumin-dose dependent manner at 24 hrs were reversed when measured at 48 hrs, showing a dose-dependent enhance. This result suggests that the curcumin treatment decrease consumption as well as production of IL-2. The change of IL-2 level induced by curcumin treatment was consistent with the suppression of lymphoproliferation. The change of IL-4 levels in the supernatant of culture exposed to curcumin at 48 was also reversed from 24 hrs like the IL-2. In conclusion, curcumin suppresses the lymphoproliferation through the blockade of both IL-2 production and consumption and has minimal effects on Th2 cytokines.

**Keyword** : curcumin, immunosuppression, cytokines