

Immunoregulatory Effects of Ethyl-acetate Fraction of Extracts from *Tetrastigma Hemsleyanum* Diels et. Gilg on Immune Functions of ICR Mice¹

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Objective To evaluate the effects of ethyl-acetate fraction (EAF) of extracts from *Tetrastigma hemsleyanum* Diels et. Gilg (TDG) on immune functions of ICR mice. **Methods** ICR mice were exposed to different doses of EAF for 15 or 30 days and then their immune functions were analyzed, including ConA-induced splenic lymphocyte transformation, SRBC-induced delayed type hypersensitivity response, serum hemolysin analysis, antibody-producing cells, peritoneal macrophage phagocytized chicken red blood cells, natural killer cell activity, and serum level of cytokines. **Results** EAF of extracts from TDG at different doses had various effects on immune functions of ICR mice. As compared with the controls, it increased the mouse spleen lymphocyte transformation induced by ConA, the left-hind voix pedis thickness and the number of plague forming cells (PFCs) at the dose of 1.82 mg/mL, 5.48 mg/mL, and 9.12 mg/mL, respectively; increased the ink clearance ability at the dose of 0.91 mg/mL, 1.82 mg/mL, 5.48 mg/mL, and 9.12 mg/mL, respectively; increased the phagocytosis index of mononuclear-macrophages and production of serum interferon-gamma (IFN- γ) at the dose of 5.48 mg/mL; and could promote the production of serum tumor necrosis factor-alpha (TNF- α) at the dose of 9.12 mg/mL. **Conclusion** EAF of extracts from TDG can regulate mouse immune functions *in vivo*.

Key words: EAF of extracts from TDG; Immuno-regulation; Cellular immunity; Humoral immunity; Macrophage phagocytosis; NK cytoactivity; Serum cytokines

REFERENCES

- Ding G Q, Zheng J X, Wei K M, Pu J B (2005). Toxicological Effects of the Extract of *Tetrastigma hemsleyanum* Diels et. Gilg on Hepatocellular Carcinoma Cell Line HepG2 and Primary Rat Hepatocytes *in vitro*. *Zhejiang Prev Med* 17(9), 1-5. (In Chinese)
- Yang X L, Luo J, Sun S B, *et al.* (1989). Researches on anti-virus function of *Tetrastigma hemsleyanum*. *Hubei Tradit Chin Med* 4, 40-41. (In Chinese)
- Zi G M, Ji L, Hu J C, *et al.* (1980). Studies of anti-inflammatory action and analysis of hemsley reckvine (*Tetrastigma hemsleyanum*). *Chin Tradit Herb Drugs* 11(4), 145-146. (In Chinese)
- Cai X L (1980). A study of *Tetrastigma hemsleyanum* on liver functions of rabbit by the application of ¹³¹I-rose Bengal. *Chin Tradit Herb Drugs* 11(1), 38-39.
- Huang Z, Mao Q Q, Wei J P (2005). Evaluation of anti-inflammatory, analgesic and antipyretic actions for the extracts from *Radix Tetrastigmae*. *Chinese Journal of New Drugs* 14(7), 861-864. (In Chinese)
- Feng Z Q, Ni K F, He Y, *et al.* (2006). Experimental study on effect of *Tetrastigma hemsleyanum* Diels et Gilg flavone on inducing apoptosis of SGC-7901 cell line *in vitro*. *Cbin J Clin Pharnlacol Ther* 11(6), 669-672.
- Li Y Q, Lu W C, Yu Z G (2003). The Study of Chemical Composition on *Tetrastigma hemsleyanum* Diels et. Gilg. *Chin Tradit Herb Drugs* 34(11), 982-983. (In Chinese)
- Kobuchi H, Roy S, Sen C K, *et al.* (1999). Quercetin inhibits inducible ICAM-1 expression in human endothelial cells through the JNK pathway. *Am Physiol* 227(3 Pt 1), C403-C411.
- Liang Y C, Huang Y T, Tsai S H, *et al.* (1999). Suppression of inducible cyclooxygenase and inducible nitric oxide synthase by apigenin and related flavonoids in mouse macrophages. *Carcinogenesis* 20, 1945-1952.
- Wang C N, Chi C W, Lin Y L, *et al.* (2001). The neuro protective effects of phytoestrogens on amyloid-protein-induced toxicity are mediated by abrogating the activation of caspase cascade in rat cortical neurons. *J Biol Chem* 276, 5287-5295.
- Lee L T, Huang Y T, Hwang J J, *et al.* (2002). Blockade of the epidermal growth factor receptor tyrosine kinase activity by quercetin and luteoin leads to growth inhibition and apoptosis of pancreatic tumor cells. *AnticancerRes* 22(3), 1615-1627.

¹This work was supported by the Scientific Research Foundation of Health Bureau of Zhejiang Province (No. 2006c151).

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12. Russo M, Palumbo R, Tedeseo I, *et al.* (1999). Quercetin and anti- CD95 (Fas / Apo1)enhance apoptosis in HPB-ALL cell line. *FEBS Lett* **462**(3), 322-328.
13. Yokoo T, Kitmnura M (1997). Unexpected protection of glomerular mesangial cells from oxidant-triggered apoptosis by bioflavonoid quercetin. *Am J Physiol* **273**(2 Pt 2), F206-F212.
14. Ishikawa Y, Kitmnura M (2000). Anti-apoptotic effect of quercetin: Intervention in the JNK and ERK-mediated apoptotic pathways. *Kidney Int* **58**(3), 1078-1087.
15. Marion R, Robert E, Brigitte M (1999). Quercetin-induced apoptosis in colorectal tumor cells:possible role of EGF receptor signaling. *Nutrition and Cancer* **34**(1), 88-99.
16. Iwao O, Kanso I, Satomi K M, *et al.* (2002). The Flavonoid kaempferol suppresses the graft-versus-host reaction by inhibiting Type I cytokine production and CD8⁺ T cell engraftment. *Clinical Immunology* **103**(2), 132-144.
17. Muthian G, Bright J J (2004). Quercetin, a flavonoid phytoestrogen, ameliorates experimental allergic encephalomyelitis by blocking IL-12 signaling through JAK-STAT pathway in T lymphocyte. *Journal of Clinical Immunology* **24**(5), 542-552.
18. Bandyopadhyay S, Lion J M, Mentaverri R, *et al.* (2006). Attenuation of osteoclastogenesis and osteoclast function by apigenin. *Biochemical Pharmacology* **72**, 184-197.
19. A. Dorhoi, V. Dobrea, M. Zăhan, P. Virag (2006). Modulatory effects of several herbal extracts on avian peripheral blood cell immune responses. *Phytotherapy Research* **20**, 352-358.
20. Sandra O G, Barbara O, Patricia M (2006). Photodynamic therapy and anti-tumor immunity. *Lasers in Surgery and Medicine* **38**, 509-515.
21. Dou Z H (2004). Immunocytology and Disease. Beijing. China Medicine and Technology Publishing House, pp. 892-901.
22. Noel Masihi K (2003). Concepts of immunostimulation to increase antiparasitic drug action. *Parasitol Res* **90**, S97-S103.
23. RAsKOVÁ G, KOVÁRU F, BÁRTOVÁ J (2005). Cytokine production by porcine mononuclear leukocytes stimulated by mitogens. *ACTA VET BRNO* **74**, 521-525.

(Received May 29, 2007 Accepted February 26, 2008)