Pharmacological Studies on Certain Mushrooms from China

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This article focuses mainly on biopharmacological studies of selected Chinese medicinal mushrooms, namely immunomodulation and antitumor activity of *Tricholoma giganteum* Massee, blood pressure lowering action and mechanism of *Volvariella volvacea* (Bull.: Fr.) Sing., and the liver protective effect of *Trametes versicolor* (L.: Fr.) Lloyd.

A polysaccharide–protein complex (PSPC) isolated from the culture filtrates of *T. giganteum* inhibited the growth of both solid and ascites Sarcoma 180 in mice, with no sign of toxicity. PSPC showed immunomodulating action *in vivo*. It restored and increased phagocytic function of macrophages and mitogenic responses of splenocytes of the tumor-bearing mice. It also exhibited indirect cytotoxicity against P815 and L929 by activating macrophages to release the mediators, such as nitric oxide (NO) and tumor necrosis factor-α (TNF-α). The direct cytotoxicity of PSPC was observed in PU5-1.8, H3B, HL-60, melanoma, and Sarcoma 180 tumor cell lines. The antiproliferative activity against PU5-1.8 cells was strong at a dose of 60 μg/ml of PSPC, but the dose needed to inhibit Sarcoma 180 cells *in vitro* was above 500 μg/ml. Flow cytometric study showed that PSPC could directly induce HL-60 cell apoptosis *in vitro*. Therefore, the antitumor activity of PSPC might be due to both host-mediated immunomodulating action and direct cytotoxicity to cancer cells.

An extracted fraction with a molecular mass of about 10 kDa from the fruiting bodies of *Volvariella volvacea* (VE) was heat stable and resistant to trypsin digestion. The blood pressure changes produced by the extract alone or in the presence of various drugs were investigated. An intravenous injection of VE produced a hypotensive effect in normotensive rats with an ED_{50} of 25 mg dry weight/kg body weight. This hypotensive effect of VE was attenuated or blunted in the presence of hexamethonium, phentolamine, pyrilamine, and cimetidine, suggesting the involvement of the α-adrenergic component of the autonomic system and/or histaminergic stimulation. The contractile response could be inhibited by the antagonists of serotonin and α-adrenoceptor, ketanserin, and phentolamine, respectively. It is likely that VE contained serotoninlike substances because the mechanism of action of VE was quite similar to that of serotonin.

The protective effects of polysaccharide peptide (PSP) of *Trametes versicolor* on hepatotoxicity were investigated using paracetamol (APAP)-induced liver injury in the rat as a chemical hepatitis model. A single oral dose of 1.0 g/kg of APAP was able to produce significantly elevated levels of serum glutamic pyruvic transaminase (SGPT) and glutamic oxaloacetic transaminase (SGOT). Intraperitoneal (i.p.) administration of 300 mg/kg of PSP could significantly reduce the APAP-induced acute elevation in the levels of SGPT and SGOT in rats. PSP probably acts to prevent the fall of hepatic reduced glutathione (GSH) through some GSH-dependent enzymes and preserves the structural integrity of the cellular membrane of hepatocytes, or probably protects against paracetamol-induced liver injury through its antioxidant properties, acting as a scavenger of free radicals even at low levels of GSH.

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