ABSTRACT

NYOMAN SUARSANA. Hypoglycemic and Antioxidative Activities of Methanol Extract of Tempe on Diabetic Rat. Under directions of BAMBANG PONTJO PRIOSOERYANTO, MARIA BINTANG, and TUTIK WRESDIYATI.

Tempe (fermented soybean) has been widely recognized as the main source of bioactive compounds such as isoflavone. This isoflavone has been proven scientifically to have antioxidative and hypoglycemic activities. The study was conducted: (1) to produce tempe containing high of isoflavone aglycone, and (2) to evaluate its antioxidative and hypoglycemic activities both in vitro and in vivo.

The tempe was produced by fermentation using Rhizopus oryzae (tempe A) and using Rhizopus oryzae and Micrococcus luteus ATCC 9341 (tempe B). Tempe A and B, fried tempe B (180°C for 5 min), and boiled tempe B (98°C for 30 min) were extracted using methanol. The methanol extracts of tempe were analyzed for α-glucosidase inhibition ability, isoflavone aglycone content, antioxidative activities and hypoglycemic ability both in vitro and in vivo. The doses of methanol extract of tempe used were (100, 200, 300 and 400 mg/kg bw), and acarbose 4.5 mg/kg bw which was known to have hypoglycemic activity were administered into temporary sucrose-induced hyperglycemic male rats. Blood glucose level was evaluated every 0, 30, 60, 120, 180 and 240 minute following treatment using Blood glucose Test Meter GlucoDr. The antioxidative and hypoglycemic activities of methanol extract of tempe was carried out in vivo using 20 male rats (diabetic and non diabetic). The diabetic condition was induced by alloxan at a single dose of 120 mg/kg bw intraperitoneally. Methanol extract of tempe was administered orally at the dose of 300 mg/kg bw/day. Blood glucose levels of rats were analysed at 0, 4, 7, 14, 21, and 28 days following treatment. At the end of treatment, all rats were sacrificed by cervical dislocation. Liver and muscle were collected to determine the glycogen level of the rats. Pancreas was also collected for analysis the level of malondialdehyde (MDA), superoxide dismutase (SOD) and glutathione peroxide (GPx), and catalase activities. The pancreas was also subjected for histopathological examination to determine the beta cells in pancreatic islet cells by hematoxyline Eosin (HE) staining, immunohistochemical staining, and by transmission electron microscopy to examine their ultrastructural figure of beta cells in pancreas.

The results showed that the total isoflavone aglicon (daidzein, glycitein, genisteen and factor 2) content of tempe B (10.65 mg/100 g) was significantly higher than tempe A (6.78 mg/100 g). Cooking processes decreased of isoflavone content of tempe. Frying of Tempe B reduces its isoflavon content of 39.15%, whereas boiling of tempe B reduces its isoflavon content of 18.20%. It was also evident that methanol extract of tempe is a potential inhibitor of α-glucosidase enzyme activities in vitro of 11.89% with IC50 value of 1.4 mg. Methanol extract of tempe at dose of 300 ppm showed a high antioxidative activity which is similar to 200 ppm butylated hydroxytoluene (BHT) with the protective factor value of 2.35 and 2.39, respectively. Methanol extract of tempe with dose of 300 mg/kg bw showed hypoglycemic effect which is similar to acarbose 4.5 mg/kg bw. The administration of methanol extract of tempe in normal rats (rat of ET group) improved of glycogen level in liver (9.29%), muscle (18.27%), SOD activity (21.2%), GPx (6.6%), catalase (10.3%), and reduced MDA level (5.07%) in pancreas. The administration of methanol extract of tempe in diabetic rats (rat of DM-ET group) can inhibit the increasing of blood glucose level (67.36%), MDA level (34.5%), maintain intracellular antioxidant enzyme activity (SOD, GPx and catalase) in pancreas, and increasing of glycogen level in liver (2.2%) and muscle (4.02%) and its can inhibited the state of pancreatic beta cells damage.

Keywords: tempe, hypoglycemic, diabetic rat, isoflavone, antioxidant enzymes.