

The reno-protective effects of dietary caloric restriction against oxidative damage and inflammation in streptozotocin-induced diabetic rats

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Abstract

Studies have shown that dietary caloric restriction (CR) without malnutrition can increase longevity. This study aims to evaluate the protective effects of CR on oxidative stress, lipid peroxidation and inflammatory cytokines in the kidney of streptozotocin-induced diabetic rats. Forty 12-week old male Wistar rats, weighing 250-275 g, were randomly divided into 4 groups. Two groups were subjected to 30 % caloric restriction and the other two to ad libitum feeding for 9 weeks. Diabetes was induced at the 10th week by a single intraperitoneal injection of streptozotocin (35 mg/kg body weight) to one caloric restricted and one ad libitum group. At sacrifice, 2 weeks after the induction of diabetes, the severe hyperglycemia in the kidney of diabetic rats fed ad libitum correlated with increases in organ weight, malondialdehyde (MDA), triglyceride (TG), oxidized glutathione (GSSG) and reactive oxygen species (ROS) concentrations, superoxide dismutase (SOD) and catalase (CAT) activities and decreased glutathione reductase (GR) and glutathione peroxidase (GPx) activities, reduced glutathione (GSH) levels and GSH/GSSG ratios. Decreased levels of tumor necrosis factor- α (TNF – α), interleukin 1 β (IL - 1 β) and interleukin – 6 (IL – 6) were also observed in these diabetic kidneys and these were postulated to be indicative of proteinuria. Caloric restriction was able to significantly reduce ROS, MDA and GSSG concentration as well as the activities of SOD and CAT under diabetic conditions. Moreover, CR produced significant increases in GPx and GR activities, GSH concentration and the GSH/GSSG ratio as well as significant increases in IL-1 β , IL-6 and TNF- α concentrations. Additionally, non-significant decreases were exhibited in the concentrations of glucose, TG and GSSG in the diabetic animals under CR. It can be concluded that caloric restriction significantly improved antioxidant status, lipid peroxidation and restored the cytokine levels to near normalcy. This study has demonstrated that these pathophysiological alterations caused by disturbed glucose homeostasis are reversed by caloric restriction and thus CR may have therapeutic/preventive potential towards the development of diabetic nephropathy.

Keywords: dietary caloric restriction; lipid peroxidation; oxidative stress; inflammation; streptozotocin-induced diabetes; nephropathy

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