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Research Article

Effect of curcumin supplementation on blood glucose, plasma insulin, and glucose homeostasis related enzyme activities in diabetic *db/db* mice

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We investigated the effect of curcumin on insulin resistance and glucose homeostasis in male C57BL/KsJ-*db*/*db* mice and their age-matched lean non-diabetic *db*/+ mice. Both *db*/+ and *db*/*db* mice were fed with or without curcumin (0.02%, wt/wt) for 6 wks. Curcumin significantly lowered blood glucose and HbA_{1c} levels, and it suppressed body weight loss in *db*/*db* mice. Curcumin improved homeostasis model assessment of insulin resistance and glucose tolerance, and elevated the plasma insulin level in *db*/*db* mice. Hepatic glucokinase activity was significantly higher in the curcumin-supplemented *db*/*db* group than in the *db*/*db* group, whereas glucose-6-phosphatase and phosphoenolpyruvate carboxykinase activities were significantly lower. In *db*/*db* mice, curcumin significantly lowered the hepatic activities of fatty acid synthase, β-oxidation, 3-hydroxy-3-methylglutaryl coenzyme reductase, and acyl-CoA: cholesterol acyltransferase. Curcumin significantly lowered plasma free fatty acid, cholesterol, and triglyceride concentrations and increased the hepatic glycogen and skeletal muscle lipoprotein lipase in *db*/*db* mice. Curcumin normalized erythrocyte and hepatic antioxidant enzyme activities (superoxide dismutase, catalase, glutathione peroxidase) in *db*/*db* mice that resulted in a significant reduction in lipid peroxidation. However, curcumin showed no effect on the blood glucose, plasma insulin, and glucose regulating enzyme activities in *db*/+ mice. These results suggest that curcumin seemed to be a potential glucose-lowering agent and antioxidant in type 2 diabetic *db*/*db* mice, but had no affect in non-diabetic *db*/+ mice.

Keywords: Antioxidant / Curcumin / Glucose homeostasis / Insulin resistance / Type 2 diabetes

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1 Introduction

Curcumin [1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadien-3,5-dione] is the active component in Turmeric Rhizomes (*Curcuma Long Linn*), which are the major component of spices turmeric and curry. These spices have been widely used in traditional medicine in Southeast Asia, and their numerous biological effects have been associated with curcumin [1]. Practitioners of traditional Indian medicine believe that curcumin powder prevents many diseases including biliary disorders, anorexia, cough, diabetes, hepatic disorders, rheumatism, sinusitis, cancer, and Alzheimer's [2]. Several studies have indicated that curcumin plays a beneficial role in terms of being an antioxidant, anti-tumurogenic, and anti-inflammatory agent [3].

A recent study showed that curcumin-treated diabetic rats had lower blood glucose and glycated hemoglobin levels, in association with lower oxidative stress [4]. Fur-

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Abbreviations: ACAT, acyl-CoA: cholesterol acyltransferase; **CAT,** catalase; **CPT,** carnitine palmitoyltransferase; **FAS,** fatty acid synthase; **FFA,** free fatty acid; **GK,** glucokinase; **G6Pase,** glucose-6-phosphatase; **GSH-Px,** glutathione peroxidase; **HbA_{1c},** glycosylated hemoglobin; **HOMA-IR,** homeostatic index of insulin resistance; **IPGTT,** intraperitoneal glucose tolerance test; **LPL,** lipoprotein lipase; **MDA,** malondialdehyde; **PEPCK,** phosphoenolpyruvate carboxykinase; **ROS,** reactive oxygen species; **SOD,** superoxide dismutase