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## Antidiabetic and Antioxidant Effects of Apple Cider Vinegar on Normal and Streptozotocin-Induced Diabetic Rats

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### Abstract

Diabetes mellitus (DM) is a globally growing health problem and one of the most prevalent endocrine disorders worldwide. Chronic hyperglycemia status favors the manifestation of oxidative stress by increasing the production of reactive oxygen species and/or by reducing the antioxidant defense system activity. In this study, the beneficial effects of apple cider vinegar (ACV) supplementation on blood glucose level, hepatic and renal toxicity and antioxidant enzyme activities in normal and diabetic rats were investigated. Four groups (8 animals/group) of male *Wistar* rats were used. The animals were fasted overnight and DM was induced by an intraperitoneal injection of freshly prepared streptozotocin (STZ). Control rats were injected with citrate buffer only. ACV was administered orally for 4 weeks. Our findings indicated that ACV increased the activity of antioxidant enzymes (superoxide dismutase ( $p < 0.001$ ), catalase and glutathione peroxidase) as well as thiol concentration ( $p < 0.05$ ). It also reduced lipid peroxidation levels (TBARS) and the indices of toxicity in liver and kidneys, by significantly decreasing aspartate and lactate transaminase (AST & ALT) activity, total and direct bilirubin ( $p < 0.001$ ), urea ( $p < 0.001$ ) and creatinine ( $p < 0.001$ ) levels. Moreover, the plasma concentration of magnesium, calcium ( $p < 0.001$ ) and copper increased after ACV administration. Iron levels however decreased. The concentration of vitamin E, an important antioxidant in vivo, was raised. In conclusion, the findings show that ACV possesses significant antihyperglycemic and antioxidant effects in an experimental model of DM, by preventing diabetic complications in liver and kidneys.

**Keywords:** Apple vinegar; oxidative stress; streptozotocin; trace metals; vitamin E.

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