

Streptozotocin-Induced Oxidative Stress in Rats: The Protective Role of Olive Leaf Extract

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This paper investigates the antidiabetic and antioxidant effects of olive leaf extract (OLE) prepared in ethanol upon Streptozotocin (STZ)-induced diabetic rats. The rats were divided into five groups (control, OLE, 40 mg/kg STZ, 0.25 g/kg OLE + STZ, and 0.5 g/kg OLE + STZ). The blood of rats was taken for determination of glucose levels besides oxidative activities (superoxide dismutase-SOD, glutathione peroxidase-GPx, glutathione-S transferase-GST activities, and malondialdehyde-MDA) and biochemical parameters (alanine transaminase-ALT, aspartate transaminase-AST, and alkaline phosphatase-ALP). While ALP, AST, ALT, and MDA levels showed an increase, SOD, GPx, and GST levels decreased in Group STZ compared to Control Group. When compared to the group given only STZ, OLE played a significant role in decreasing MDA, ALT, AST, and ALP levels, apart from increasing GPx, and GST following treatment of diabetic rats. As a result, the *in vivo* data obtained have shown that the OLE has an antidiabetic effect thanks to restricting oxidative stress and reinforcing antioxidant activities.

Keywords: Streptozotocin, Diabetes mellitus, Olive leaf extract, Antioxidant, Rat

Introduction

A chronic metabolic disease, diabetes mellitus (DM) is acknowledged to have the highest prevalence and mortality rates across the globe and develops due to either insufficient amounts of insulin in the body or a total lack of it, or simply because of its reduced activity.¹ It is associated with hyperglycaemia and long-term complications that affect the eyes, kidneys, blood vessels, and nerves. It is also known as the most common of all endocrine disorders. While the chief mechanism of diabetic complications remains to be clarified, a great deal of attention has been drawn to the role of oxidative stress in diabetes in recent times. It has been reported that oxidative stress can contribute to the pathogenesis of diverse diabetic complications.² Added to that, a number of phenomena emerge in developing diabetes, such as a rise in lipid peroxidation,³ altered glutathione redox, lowered individual natural antioxidants, and, last of all, reduced antioxidant enzyme activities.⁴ All these changes indicate oxidative stress attributable to hyperglycaemia.⁵ Several defense mechanisms have also been shown to contribute to Streptozotocin-induced (STZ-induced) oxidative damage, among which are antioxidants that act as free-radical scavengers.^{6–9} At the present time, the popularity of herbal drugs is gaining momentum in treating diabetes along with the complications associated with it. In developing strategies for alleviation of oxidative damage in diabetic patients, natural antioxidants have come

to the fore in the current studies conducted on diabetes. Studies have suggested that most of the negative consequences of oxidative stress could be reduced by supplementing it with some dietary antioxidants.^{10,11}

Olive leaves are reported to possess the highest antioxidant activity considering the phenolic components they contain, which are indispensable elements of a healthy diet.^{12–14} They contain three different compounds, mainly flavonoids, secoiridoids, and triterpenes. The most effective active ingredient of an olive leaf is oleuropein, a natural product of the secoiridoid group. Phenolic substances and their amounts in OLE are presented in Table 1.¹⁵

The amount of oleuropein has the highest rate with a value of 24.54% and is highlighted in the literature as the main component of olive leaves, whose strong antioxidant effect is attributed to oleuropein.^{13,15–17}

OLE is known for its antioxidant activities and chemical compositions.^{18–20} Added to that, OLE also possesses antidiabetic and antihypertensive properties.^{21,22} The extracts prepared with olive leaf have exhibited antioxidant effects close to those of hydroxytyrosol antioxidants, while also showing stronger antioxidant effects than those of vitamins C and E.^{23,24}

While there are known to be studies into the extract of the olive leaf prepared in water for their antidiabetic and antioxidative properties, no studies are available that have investigated these properties in the extract of olive leaf prepared in ethanol. For this reason, the present study aims to