Asian Journal of Healthy and Science
p-ISSN: 2980-4302
e-ISSN: 2980-4310
Vol. 2 No. 7 July 2023

ROD UNCARIA GAMBIR (W. HUNTER) ROXB.'S ANTIOXIDANT ACTIVITY IN STREPTOZOTOCIN-INDUCED DIABETIC RATS

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Abstract

To ascertain whether Uncaria gambir (W. Hunter) Roxb.'s ethanol extract can reduce diabetes complications due to its antioxidant activity. Sprague Dawley rats with diabetes were induced by streptozotocin. The purpose of this study was to determine rod uncaria gambir (w. hunter) roxb.'s antioxidant activity in streptozotocin-induced diabetic rats. Twenty-five rats were divided into four groups: the negative control (k-), which received 1% Na-CMC; the extract group (P1, P2, and P3) with doses of 50 mg/Kg BW, 75 mg/Kg BW, and 100 mg/Kg BW for 21 days. Rats received therapy for 21 days before being fasted the following morning and sacrificed. Measure the level of Hydrogen peroxide, Malondialdehyde (MDA), changes in Catalase activity, and Superoxide Dismutase (SOD) levels in blood plasma used spectrophotometric. In comparison to diabetic rats receiving of Na-CMC, and ethanol extract for 21 days resulted in noticeably greater Catalase enzyme activity and a decrease in levels of Malonaldehyde and Hydrogen Peroxidas However, it was unable to boost superoxide dismutase activity. Uncaria gambir (W.Hunter) Roxb. extract has the ability to prevent diabetic complications in diabetic rats due to its antioxidant activity and previously noted antihyperglycemic effects.

Keywords: rod uncaria gambir; antioxidant activity; streptozotocin-induced

INTRODUCTION

A metabolic disorder called diabetes mellitus is becoming more common everywhere in the world. The most prevalent kind of diabetes is type 2 diabetes mellitus, which is frequently brought on by insulin resistance and inadequate insulin production. Oxidative stress is a result of an imbalance between the body's endogenous antioxidant mechanisms and the creation of free radicals, which occurs in diabetes (Alwin Robert et al., 2017). One of the main causes of diabetes complications, including endothelial dysfunction, damaged pancreatic beta cells, and reduced organ function, is oxidative stress.

The development of diabetic problems such as retinopathy, neuropathy, and nephropathy, which can injure cells, is associated with oxidative stress, in which there is an imbalance between the production of free radicals and the body's

antioxidant defenses. Given this fact, glycemic management techniques must be employed with successful treatment strategies for this illness.

Antioxidant medications that can help shield cells from harm caused by high blood sugar levels are one strategy to treat diabetes. The utilization of traditional medicinal plants as natural sources of antioxidants that may help manage diabetes and its complications has received much attention in recent years.

In Indonesia and other Southeast Asian nations, Uncaria gambir (W.Hunter) Roxb has long been used in traditional medicine to treat various ailments, including diabetes. This plant includes bioactive substances found to have antioxidant and anti-diabetic properties, including flavonoids, tannins, and alkaloids.

Uncaria gambir (W.Hunter) Roxb has been shown to have potential as an antioxidant and anti-diabetic drug. However, more study is still required to fully understand how it works and how it affects animal models of diabetes. Therefore, this paper aims to assess Uncaria gambir's antioxidant activity in streptozotocin-induced diabetic rats. New knowledge on Uncaria Gambir (W. Hunter) Roxb.'s potential as an antioxidant medicine for treating diabetes mellitus is anticipated to come from this study.

RESEARCH METHODS

In Palangkaraya City, the Marang and Bukit Batu areas of Central Kalimantan, Uncaria Gambir rod were gathered. The procedure for sample maceration involved submerging the sample for three consecutive 24-hour periods in a 1:10 solvent solution made up of 96% ethanol. The container is covered, kept at ambient temperature, shielded from light, and in a cool location. It was filtered, new 96% ethanol was added as the solvent, and it was agitated once every 24 hours. After being macerated for three days, the macerate was concentrated using a rotary evaporator at 60°C. The filtrate was stored for subsequent use after evaporating with a porcelain cup in a water bath at 60°C

For this investigation, 25 male Rattus Novergicus rats between 12 and 16 weeks were used. Before the trial began, mice were acclimated for two weeks to a typical diet of pelleted rat chow, with water available as needed at room temperature. All rats had blood drawn from their tail veins to examine their blood sugar levels 72 hours after receiving 45 mg/kg BW of streptozotocin (STZ). The rats were randomized and separated into four treatment groups, each with five animals, following the occurrence of hyperglycemia: Group UG 50: Uncaria gambir rod extract dose of 50 mg/kgBB+STZ; Group UG 75: Uncaria gambir rod extract dose of 75 mg/kgBB+STZ; Group UG 100: Uncaria gambir rod extract dose of 100 mg/kgBB+STZ; and negative control group: 1% Na-CMC + STZ. Rats received therapy for 21 days before being fasted the following morning and sacrificed.

Cardiovascular puncture was used to collect blood, which was then spun at 3000 rpm for 10 min and the plasma was examined to gauge several biochemical markers.

Serum MDA levels were determined using the Yagi technique and thiobarbituric acid (TBA)(Teugwa et al., 2013). Peroxide of hydrogen Jiang et al. previously described a method for determining the hydrogen peroxide content(Jiang et al., 1992). Sinha technique was used to assess catalase activity in blood and organ homogenates(Teugwa

et al., 2013). The Misra and Fridovich(Misra & Fridovich, 1972) approach was utilized to determine cardiac SOD activity in this investigation.

Kruskall Wallis was used to test the data, using a confidence interval of 95% and a threshold of 0.05. SPSS is used to validate all data. Another test used is the Mann-Whitney.

RESULT AND DISCUSSION

The effect of Uncaria Gambir rod extract on plasma hydrogen peroxide levels of mice treated with STZ is shown in Figure 1. Increased peroxide activity was seen in rats induced by STZ. Treatment with Uncaria Gambir rod extract at a dose of 75 mg/kg body weight reduced hydrogen peroxide levels by 19.35% compared to treatment with Uncaria Gambir rod extract at a dose of 50 mg/kg body weight which reduced by 12.09%. The hydrogen peroxide levels of the extract were reduced by 31.02% when administered at 100 mg/kg BW.

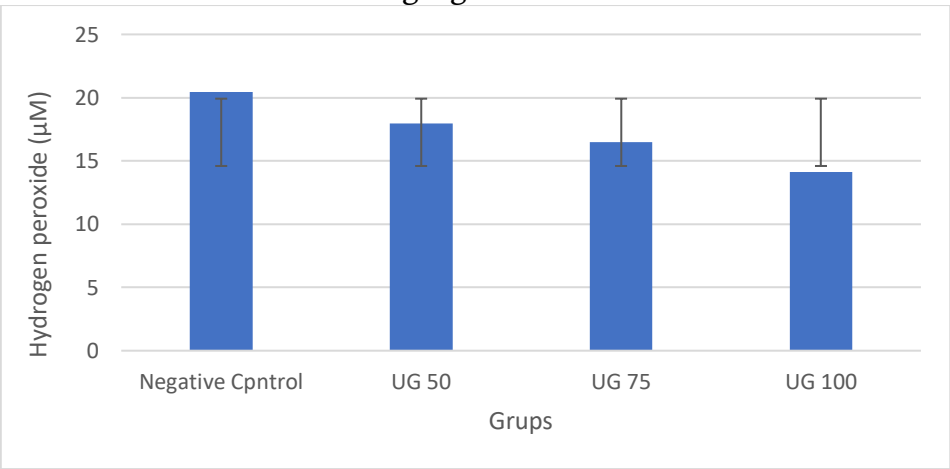

Figure 1.
Effect of Uncaria Gambir rod extract on plasma peroxide activity of STZ-induced rats. Grups UG 50: Uncaria gambir rod extract dose of 50 mg/kgBB+STZ; Group UG 75: Uncaria gambir rod extract dose of 75 mg/kgBB+STZ; Group UG 100: Uncaria gambir rod extract dose of 100 mg/kgBB+STZ; and negative control group: 1% Na-CMC + STZ

The effect of Uncaria Gambir rod extract on MDA levels in the plasma of STZ-induced rats is shown in Figure 2. MDA levels were shown to increase after STZ induction. MDA levels decreased by 5.25% after treatment with 100 mg/kg BW of Uncaria Gambir rod extract. In contrast, the dose of 75 mg/kg body weight showed a decrease in MDA levels of 4.01%. Treatment with a 50 mg/kg BW dose resulted in a 2.77% reduction in MDA levels.

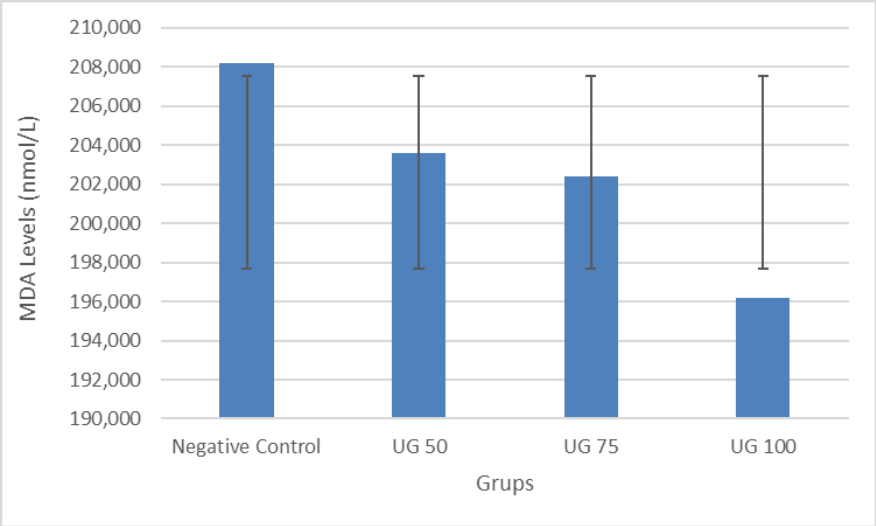

Figure 2.
Effect of Uncaria Gambir rod extract on plasma level MDA of STZ induced rats

Group UG 50: Uncaria gambir rod extract dose of 50 mg/kgBB+STZ; Group UG 75: Uncaria gambir rod extract dose of 75 mg/kgBB+STZ; Group UG 100: Uncaria gambir rod extract dose of 100 mg/kgBB+STZ; and negative control group (K-): 1% Na-CMC + STZ

Figure 3 displays the outcomes of the Uncaria Gambir rod extract's impact on the plasma catalase activity of rats given STZ. In rats given STZ, there was an increase in catalase activity. Treatment with Uncaria Gambir rod extract at 50 mg/kg BW, and 75 mg/kg BW decreased activity by 13.33% and 13.73%, respectively. In the group of rats given a 100 mg/kg BW dosage, there was a 14.39% drop in catalase activity.

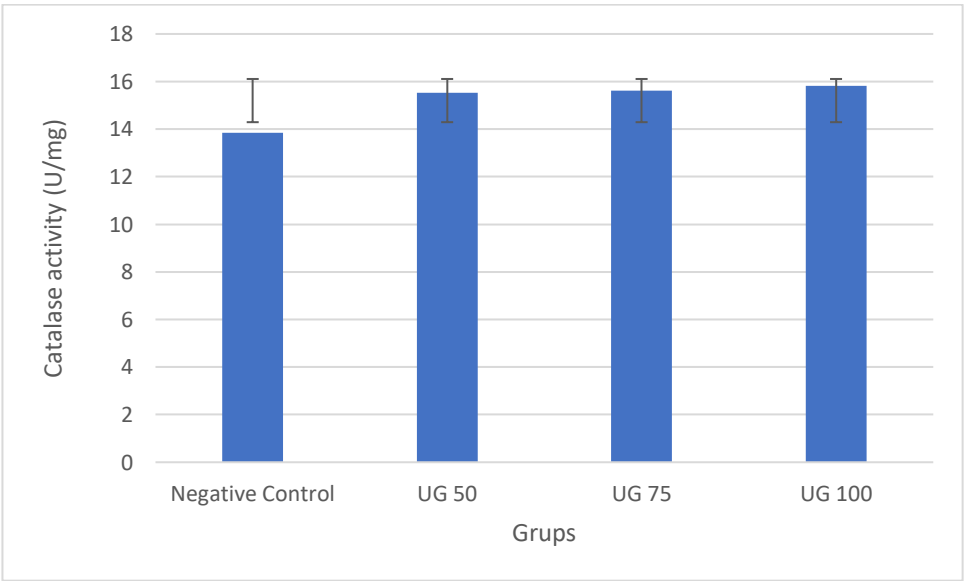

Figure 3. Effect of Uncaria Gambir rod extract on plasma Catalase activity of STZ-induced rats

Group UG 50: Uncaria gambir rod extract dose of 50 mg/kgBB+STZ; Group UG 75: Uncaria gambir rod extract dose of 75 mg/kgBB+STZ; Group UG 100: Uncaria gambir rod extract dose of 100 mg/kgBB+STZ; and negative control group (K-): 1% Na-CMC + STZ.

Figure 4 depicts the effect of Uncaria Gambir rod extract on STZ-treated mice's plasma SOD activity. Catalase activity was increased in STZ-induced rats. Catalase activity was reduced by 14.39% in the rat group, given a 100 mg/kg BW dosage. Treatment with 50 mg/kg BW and 75 mg/kg BW Uncaria Gambir rod extract reduced activity by 13.33% and 13.73%, respectively.

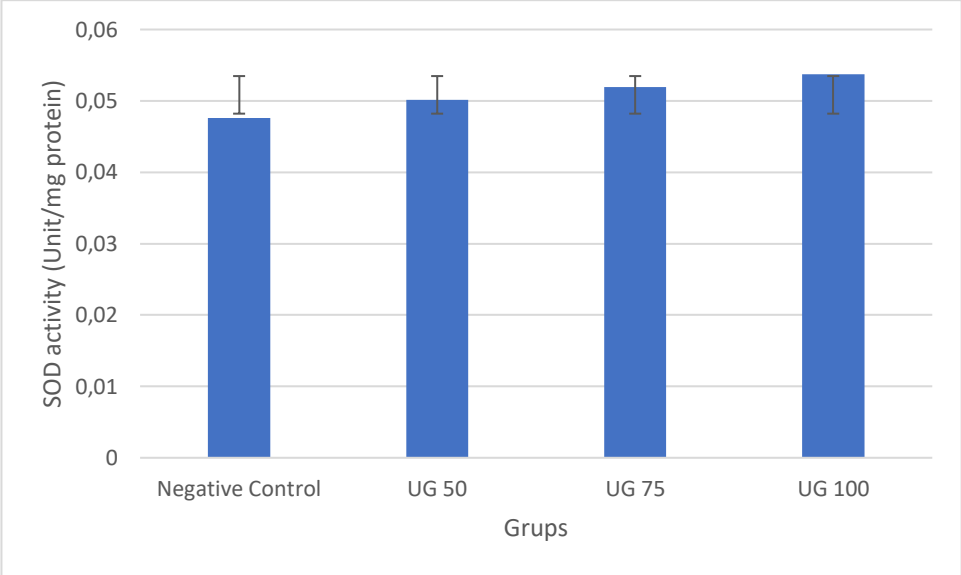

Figure 4. Effect of Uncaria Gambir rod extract on plasma SOD activity of STZ-induced rats

Group UG 50: Uncaria gambir rod extract dose of 50 mg/kgBB+STZ; Group UG 75: Uncaria gambir rod extract dose of 75 mg/kgBB+STZ; Group UG 100: Uncaria gambir rod extract dose of 100 mg/kgBB+STZ; and negative control group (K-): 1% Na-CMC + STZ.

Streptozotocin (STZ) is an antibiotic derived from Streptomyces achromogenes. STZ is toxic and may cause an autoimmune reaction in pancreatic cells. This STZ pathway induces oxidative stress and can be exploited to induce diabetes in diabetic animal models(Hamzah et al., 2023)·(Ekong et al., 2022). Streptozotocin decreases the ability of pancreatic Langerhans beta cells to make insulin by generating highly reactive free radicals that can destroy cell membranes, proteins, and DNA(Saputra et al., 2018). Diabetes and cellular damage to multiple body organs are both caused by oxidative stress, which can also result in cellular damage, such as lipid peroxidation(Jamal Gilani et al., 2021). The STZ dose used in this study, according to Fauzul H et al,.(Husna et al., 2019) was 45 mg/kg BW. At moderate doses (40-55 mg/kg BW), streptozotocin injections might cause partial insulin secretion abnormalities akin to type 2 diabetes.

Alexandra et al.,(Alexandra et al., 2023) previously reported substantial hyperglycemia in rats after STZ induction at a dosage of 45 mg/kg BW.

Hyperglycemia in diabetes can lead to oxidative stress by the auto-oxidation of glucose in the aldehyde group, which produces superoxide (O2-), hydroxyl radicals (OH*), and hydrogen peroxide (H_2O_2)(Asmat et al., 2016). In diabetics, this oxidative stress condition leads to increased free radical generation and decreased antioxidant status(Bhatti et al., 2022).

MDA is often utilized as an oxidative stress marker in diabetes, along with hydrogen peroxide, SOD, and catalase. Free radicals cause lipid peroxidation, which releases a substantial amount of MDA. MDA levels in plasma can thus indicate the extent of cell damage and apoptosis in diabetic humans or animals(Tangvarasittichai, 2015). All rats fed with the extracts had low MDA and H_2O_2 levels and a significant increase in catalase but there was no significant different activity of SOD, demonstrating their antioxidant efficacy in streptozotocin-induced rats. As a result, these extracts may significantly promote the removal of free radicals associated with the incidence of diabetes.

The principal antioxidant enzyme that neutralizes superoxide is superoxide dismutase (SOD). This enzyme functions by facilitating the conversion of superoxide to hydrogen peroxide. When the body is subjected to oxidative stress, it responds by creating antioxidants such as superoxide dismutase (SOD), glutathione peroxidase (GPx), and catalase (CAT)(Rosa et al., 2021). Antioxidants play specific roles in decreasing the impacts of free radicals. However, if oxidative stress persists, the body may suffer enough damage that it is unable to create antioxidants to compensate. As a result, there were no significant variations in superoxide dismutase activity across groups in this investigation(Julio Suhardi et al., 2016)

CONCLUSION

This study found higher catalase and SOD activity in rat blood plasma, lower MDA and hydrogen peroxide levels, and the protective effects of Uncaria Gambir rod against STZ-induced lipid peroxidation.

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