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Original Article

The Effect of Cinnamon Bark Extract *(Cinnamomum burmanii)* on Catalase Activity Levels in Hyperglycemic Rats

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ABSTRACT

Background: Hyperglycaemic is a condition characterized by elevated blood glucose levels, with serum blood glucose levels exceeding 126 mg/dL. Hyperglycaemia can induce oxidative stress. Oxidative stress occurs due to an increase in free radicals or a decrease in antioxidant defense activity. Cinnamon bark can enhance antioxidant levels and decrease indicators of oxidative stress. This study examines the impact of cinnamon bark extract on catalase activity levels in hyperglycaemic rats.

Method: This study used an experimental design with a post-test-only group design. The rats were divided into 5 groups, namely the negative control group (K-), the positive control group (K+), treatment group 1 (dose 100 mg/kgBW), treatment group 2 (dose 200 mg/kgBW) and treatment group 3 (dose 300 mg/kgBW) with 6 rats each. The normality test was carried out using the Shapiro-Wilk test followed by One Way ANOVA.

Result: The administration of cinnamon bark extract has been shown to increase catalase activity levels. The most significant increase was observed in dose group 1, with an average of 5.62 Units/mg.

Conclusion: Administration of bark extract has been shown to increase catalase activity in hyperglycaemic Rats.

INTRODUCTION

Diabetes Mellitus (DM) is a disease that is caused by a metabolic disorder that is characterized by increased blood sugar levels or hyperglycemia[5]. According to the International Diabetes Federation 2022, diabetes mellitus is a chronic disease characterized by metabolic disorders that lead to elevated blood glucose levels. According to the International Diabetes Federation 2022, the global incidence of diabetes mellitus has reached 537 million people, aged 20-79 years. The statistical probability of death from diabetes mellitus is 6.7 million, or one person every five seconds. The increase in prevalence is attributed to changes in lifestyle, including dietary habits, the type of food consumed, lack of physical activity, obesity, hypertension, and genetic factors.

Diabetes mellitus is generally classified into two types: Type 1 Diabetes Mellitus and Type 2 Diabetes Mellitus[15]. Type 1 diabetes mellitus is an autoimmune disease that can damage pancreatic beta cells, leading to insulin deficiency. If there is no insulin hormone, glucose cannot be taken up by the tissue, so glucose levels in the blood increase, this condition is called hyperglycemia[1].

Hyperglycemia is a condition in which blood glucose levels increase above normal values. Hyperglycemia can induce oxidative stress. Oxidative stress occurs due to increased free radicals or decreased antioxidant defense activity, this condition is often known as reactive oxygen species (ROS) and reactive nitrogen species[6]. Oxidative stress is a condition characterized by an imbalance between oxidants *(free radicals)* and antioxidants in the body, which can lead to cell damage[17].

The body also has natural endogenous antioxidants in the body such as superoxide dismutase (SOD), catalase, and glutathione peroxidase (GPx) which will reduce free radicals naturally in the body. If free radicals continue to increase in the body, it can cause a decrease in the activity of antioxidant enzymes[4]. The catalase enzyme is highly susceptible to free radicals. Therefore, it can be used as an indicator to determine if oxidative stress has occurred in the body. The catalase enzyme functions to ward off free radicals by converting hydrogen peroxide (H2O2) into water (H2O) and oxygen (O2) so that it can protect cells from oxidative damage[3].

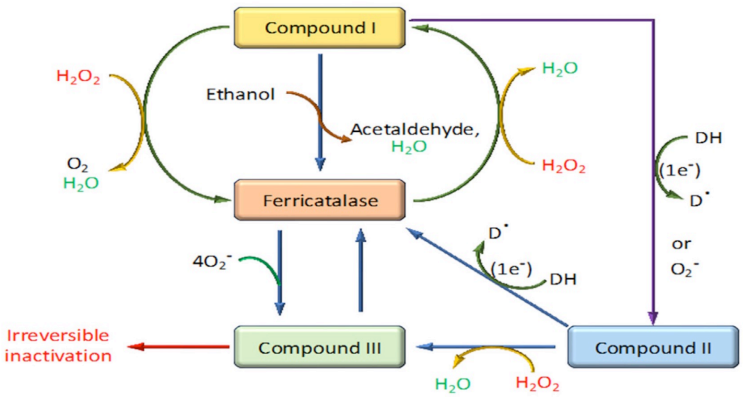

Figure 1. Reaction mechanism of catalase

High levels of reactive oxygen species trigger oxidative stress conditions so that natural antioxidants in the body decrease because antioxidants from outside the body (*exogenous antioxidants*) are needed. One example of exogenous antioxidants is those from fruits, vegetables, spices, and herbal plants[10]. Indonesia is a country rich in spices. These spices can be used as natural exogenous antioxidants to reduce free radicals in the body, one of the spices that is abundant in Indonesia is cinnamon bark.

Cinnamon Bark is rich in antioxidants and other compounds, namely compounds such as eugenol, safrole, cinnamaldehyde, and tannin. Cinnamon bark extract can produce 68.65% cinnamaldehyde compounds as a source of antioxidants to ward off free radicals. Cinnamaldehyde compounds are included in the phenylpropanoid group which are phenol derivative compounds that play an important role in antioxidant activity[9].

The cinnamaldehyde compound in cinnamon bark can lower blood glucose levels because cinnamaldehyde can inhibit the alpha-glucosidase enzyme to break down polysaccharides and disaccharides into glucose. Then cinnamon also has a compound MHCP (methylhydroxy chalcone polymer) which has the ability similar to insulin, namely to convert glucose into energy and glycogen[14]. MHCP compound is a

flavonoid compound that works like insulin. Flavonoid compounds are antioxidants that can reduce free radicals and block the induction of inflammatory mediators that can damage pancreatic cells[11].

Based on these problems, researchers are interested in researching the effect of cinnamon bark extract on catalase activity levels in hyperglycemic rats.

METHOD

This study is an experimental study using the Post Test-Only Control Group design using experimental animals, namely white rats of the Wistar strain as research objects. The experiment was conducted with a completely randomized design with several treatments arranged randomly for all experimental units.

The research sample was 40 rat which were then divided into 5 experimental groups, namely, negative control group (K-), positive control group (K+) alloxan induction, treatment group (P1) dose of 100 mg/kg BW, treatment group (P2) dose 200 mg/kgBW, treatment group (P3) dose 300 mg/kgBW. Cinnamon bark extract was given for 30 days, then blood was taken from the rats, and catalase activity was examined in each rat's treatment. Data were analyzed using the SPPS-20 program. For numerical and categorical data, the Shapiro-Wilks test will be used to determine data normality as a requirement for using One-way ANOVA. For non-normal data, the Kruskal Walis test will be used.

RESULT AND DISCUSSION

The results of measuring catalase activity in hyperglycemic rats given cinnamon bark extract (Cinnamomum burmanii) can be seen in the figure 2 below.

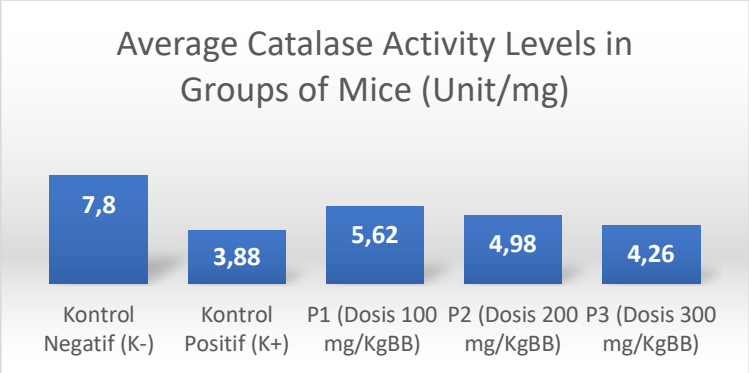

Figure 2. The Effect of Cinnamon Bark Extract (Cinnamomun burmanii) on Catalase Activity Unit/mg.

Figure 2 shows that the average catalase activity in the group given cinnamon bark extract was highest in treatment group 1 (dose 100 mg/kgBW) with an average of 5.62 Units/mg compared to treatment groups 2 and 3. Meanwhile, the lowest average catalase activity was in the positive control group with an average of 3.88 Units/mg.

The reduction in catalase activity levels in the positive control was due to the administration of alloxan, which induced oxidative stress conditions in hyperglycemic rats, leading to a decrease in endogenous antioxidants[7].

Alloxan causes a decrease in catalase activity through damage to pancreatic beta cells and redox imbalance that causes cells to experience oxidative damage, resulting in poor insulin sensitivity for glucose uptake by tissues so that blood glucose levels increase and then produce free radicals. Increased free radicals then trigger antioxidant enzymes to try to neutralize the free radicals, where the antioxidant enzyme that acts here is catalase activity[12]. Next, a follow-up test was conducted to determine at what dose the effect began to be meaningful or significant *(Bonferroni Post-Hoct test)*, can be seen in the following table.

Table 1. Results of the Bonferroni Post-Hoc Test of the Effect of Cinnamon Bark Extract on Catalase Activity Unit/mg.

Dependent Variable	Group	Group	p
Catalase Activity	control (+)	P1(Dose 100mg/kgBW)	0,001
		P2(Dose 200mg/kgBW)	0,082
		P3(Dose 300mg/kgBW	1,000

Based on Table 1, there was a significant difference between the hyperglycemia group (control +) and the treatment group given cinnamon bark extract in treatment 1 (dose 100 mg/kgBW) (P<0.05). However. In treatment group 2 (dose 200 mg/kgBW) and treatment 3 (dose 300 mg/kgBW) with the positive control group, there was no statistically significant difference in the mean.

In the group of rats given cinnamon bark extract at a dose of 100 mg/kgBW (P1), the average catalase activity level was 5.62 units/mg, an increase in catalase activity compared to the positive control group. Cinnamon bark extract in group P1 (dose 100 mg/kgBW) was the most effective dose in increasing catalase activity. The group of mice given cinnamon bark extract at 200 mg/kg BW (P2) had an average catalase activity lower than the P1 group, which was 4.98 units/mg. The group of rats given cinnamon bark extract at 300 mg/kg BW (P3) had a catalase activity level of 4.26 units/mg, whereas in group P3 the catalase activity obtained was lower than P2 but higher than the Positive Control group (K+).

The group of mice given cinnamon bark extract experienced an increase in catalase activity, this is due to the antioxidant content in cinnamon bark. Bioactive compounds contained in cinnamon bark such as trans-cinnamaldehyde are a source of antioxidants that capture free radicals[18,19]. Cinnamon bark also contains many phytochemical compounds from the phenylpropanoids class in the form of cinnamic acid. This compound can function as an antioxidant that can prevent the formation of free radicals, eliminate radicals before damage occurs, and repair oxidative damage[13,20]. Cinnamon bark is effective in increasing catalase activity in groups of mice that are given treatment where catalase can reduce free radicals by converting hydrogen peroxide into water and oxygen so that oxidative stress conditions can be suppressed[21-23].

The higher the dose level of cinnamon bark given causes hepatotoxic effects, which can be seen in Table 1, showing that the higher the dose of cinnamon bark given, the higher the blood glucose levels compared to the low dose given. Thus, free radicals in the body are still high and cause lower catalase activity antioxidants at high doses[24,25].

CONCLUSION

Based on the research that has been conducted, namely the effect of cinnamon bark extract *(Cinnamomum burmanii)* on catalase activity levels in hyperglycemic rats, it was concluded that cinnamon bark extract *(Cinnamomum burmanii)* affects increasing catalase activity in hyperglycemic rats.

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