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Effect of Water Cinnamon at A Dose of 150 mg/kg Body Weight to Level of Adiponectin on Diabetic Rats

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***Abstract*-Cinnamon is a member of the family Lauracea that is popular as an aromatic evergreen tree or shrub. In daily life cinnamon is used in fragrance of many things such as foodstuffs, perfumes, and medical products. Cinnamon contains polyphenols such as vanillic, gallic, protocatechuic, and ferulic acids, as well as eugenol that are dominantly found in its leaf. Cinnamon also contains antidiabetic, antibacterial, and antihemorrhagic agents. As antidiabetic agent, cinnamon decreases blood sugar in diabetic patients, but its effect on adiponectin is rare. This study was carried out to find out about the effect of steeping cinnamon on the adiponectin level indiabetic rats. Fifteen *Sprague Dawley* Rats were divided into three groups: normal, uncontrolled diabetic, and group treated by steeping cinnamon at a dose of 150mg/kg/day. Serum was collected during 14 days. Adiponectin was measured with ELISA method. The result of the study revealed that group I was used as the normal adiponectin values (733 ± 200 ng / mL to 763 ± 142.5 ng / mL). Adiponectin levels decreased in diabetic rats (group two) (p = 0.07). On the other hand, a group treated by steeping cinnamon at a dose of 150mg/kg/day showed an increased level of adiponectin (1.4% - 34.5%). To summarize, cinnamon water could increase the adiponectin level in diabetic rats.**

Keywords: adiponectin, Cinnamomum burmanii, diabetics.

I. INTRODUCTION

The occurrence of Diabetes mellitus (DM), a chronic disease caused by disruption of insulin secretion or insulin receptor, or both, is recently increasing in the world. More than 80% of death due to DM occurred in developing countries, including Indonesia. Insulin resistance in DM Patients influences fat metabolism due to an increase in the activity of hormone-sensitive lipase in adipose tissue. Thus, it leads to an increase in lipolysis, resulting in high free fatty acid or hypertriglyseridemia [1]. Hypertriglyceridermia is often followed by protein dysregulation from adipocyte, such as hypoadiponectinemia and Plasminogen Activator Inhibition *1* (PAI-1). Adipose tissue secretes bioactive secretory protein called adipocyitokine. Adiposcytokine produces some cytokines such as adiponectin, leptin, resistin, IL-6 and TNF-α [2].

Adiponectin is an adipocyte-derived peptide that is exclusively and abundantly expressed in adipose tissue, belonging to the collectin family [3]. Adiponectin is present abundantly in the circulation, which is around 0.01% of the total plasma protein [4]. Adiponectin level in diabetic patients with coronary artery disease is low [5]. It is assumed that adiponectin may have a role in protection against vascular damage. The adiponectin level in mice with diet-induced obesity is low due to insulin activity disorder [6]. Patients suffering from obesity and metabolic syndrome are found to have a low level of adiponection [7]. Meanwhile lower serum adiponectin levels leading to abnormal glucose metabolism is associated with the development of type 2 diabetes mellitus [8].

DM is related to a long-term complication on some organ disorders such as atherosclerosis on heart, brain, peripheral nerve disorder, retina and renal. In this case, DM could be controlled by diet management, regular physical activity and antidiabetic medications [9]. However, current antidiabetic synthetic medicine used by DM Patients has side effects and it is costly. Accordingly, it is necessary to find alternative medicines that are risk-free and affordable. One of the alternative medicines used in DM is herbal medicine, such as cinnamon.

Some people have already usedherbal medicines to cure DM such as *Cinnamomum burmanii. Cinnamomum burmanii* improves glucose intolerance, metabolic syndrome, and type 2 DM [10]. However, the mechanism of cinnamon to improve diabetes is still unclear. Therefore, this research aimed to reveal the effect of cinnamon water on the adiponectin level of diabetic patients using diabetic rats as the animal model.

II. MATERIAL AND METHODS

A. Animal Preparation

Twenty five rats (male, 2 month old, 250 gr) were acclimated to an animal laboratory with the standard laboratory

for experiment for a week. There were three treatment groups: Group I as the normal group (healthy rats), Group II as the negative control (Diabetic rats with no treatment), and Group III as the experimental group with water cinnamon at a dose of 150 mg/Kg/day.

B. Infused Cinamon Preparation

Cinnamon sticks were purchased from a grocery store. These sticks were ground with a grinder. The powder (98.5 g) was boiled in 100ml hot water (around 90º C) for fifteen minutes, then allowed to cool down before filtered using Whatman #1 paper. The cinnamon water was kept in a refrigerator. The subsequent dilutions of cinnamon water used in the diabetic rat experiments were then measured at 150mg/kg.

C. Diabetic Rat Preparation

Twenty rats prepared as the diabetic rat models were induced with *Streptozotocin (STZ*) and *Nicotinamid* (NA) combination. The rats were not given any foods and drinks for around eight hours before being treated. Firstly, they were induced with NA 120 mg/kg. Secondly, after fifteen minutes, the rats were induced with STZ 60 mg/kg. Blood glucose was measured on day three (The blood Glucose more than 200mg/dl).

D. Blood Glucose Measurement

Blood glucose measurement was done three times: before being induced with the combination of STZ and NA, three days after being induced, and fourteen days after being induced. GOD-PAP (Blood Glucose Test "Enzymatic Colorimetric Test") kit was used to measure blood glucose. The procedure was based on the manual kits.

E. Adiponectin Measurement

Adiponectin measurement was based on the procedure issued by the manufacture of the kit.

F. Statistical Analysis

All data were expressed as mean ±SD. One-way ANOVA was employed to determine the main treatment effects. To reveal the significance difference among groupsthe LSD (Least Significance Difference) test was used.

III. RESULT AND DISCUSSION

The average adiponectin levels were different in each group. Table 1 shows that on day 0 to day 7th, the adiponectin level of Group I increased, that of group II was stable but decreased on day 7 to day 14, while that of group III increased on day 7 to day 14.

One-Way ANOVA was applied to show the significance difference among groups. On the 7th day, there was no significance difference (p = 0.24), however, on the 14th day (p = 0.025), there was a significance difference. The analysis followed the LSD test.

Table.1. Average of adiponectin level for 14 days

Group	Level of Adiponectin (ng/mL)		
	Day 0	Day 7th	Day 14th
I: Normal	763.0 ± 142.5	817.0 ± 105	733.0 ± 200
II: Negative control	944.0 ± 15.5	932.2 ± 172	605.6 ± 204
III: Infused 150 mg/kg body weight/day	732.8 ± 120	743.6 ± 87.3	999.8 ± 215.6

Group I as the normal group was used as the standard adiponectin level in rats. The changes in the adiponectin levels during treatment using cinnamon water are shown in Table 2.

Table 2 shows that on day seven, the normal rats still had normal adiponectin level, however, on the diabetic group, the adiponectin level decreased and this occurred to group III as well. On day fourteen, group II as the negative control showed worse adiponectin level (decreased 35%), however, as shown in Table 2, group III (steeping of 150 mg cinnamon) had improved level of 34.5%.

Table 2. Percentage of increased adiponectin on the 7th and 14th days

Group	Percentage of Increased Adiponectin	
	Day 7th	Day 14th
I: Normal Rat	+7%	-10%*
II:Negative control (Diabetic rat)	-1.2%*	-35%*
III : water cinnamon of 150 mg/Kg/day	+1.40%	+ 34.50%

Cinnamon intake at a dose of 150mg/Kg body weight in seven days increased the adiponectin level in diabetic rats by 1.45 %, leading to a recovery of the diabetic condition. In fact, the adiponectin level increased 34.5 % in 14 days. This condition was controlled by insulin mimetic from cinnamon water. This is in line with a previous research which reported that cinnamon water extract (60g/100ml) is able to increase adiponectin and HDL levels, but decrease the level of total cholesterol, blood glucose, and triglyceride of rats with high-fat feeding and dexamethasone injection [11].

In this study, the dose of cinnamon was lower than dose 60mg/100 ml pure water. This means that the cinnamon water had a strong effect to control the adiponectin level on diabetic rats even though at a lower dose.

Diabetes is a metabolic syndrome disorder due to a low insulin sensitivity. An effect of type 2 DM is a decrease in adiponectin level as in obesity and metabolic syndrome [2]. A low adiponectin level could be a predictor of prediabetes in Asian Indians [12]. This is in line with another report that mentioned that a low adiponectin level was found on type 2 DM in Japanese population [13]. Meanwhile, Kadowaki and Yamauchi reported that adiponectin could improve insulin resistance and diabetes in murine models of type 2 diabetes [7].

As shown in Table 2, the diabetic groups (negative control / group II) had a decreased adiponectin level (1.2 % - 35 % significantly ($p = 0.07$). This phenomenon was caused by some factors such as uncontrolled DM. The average adiponectin level in this group was normal and was not significantly different to that in the normal group. Similar to the controlled diabetic group, the adiponectin level was normal [14].

Group II (150 mg/Kg cinnamon water) showed an increased adiponectin level of around 1.4-34.5% ($p = 0.026$). Cinnamon is known to contain Methyl hydroxychalcone polymer (MHCP) or cinnamtannin B1 which has similar activity to insulin (insulin mimetic*)* [9]. In line with a study from Kopp C, trans-cinnamic acid in cinnamon is able to stimulate the secretion of adipoQ and regulate phosphorylation of AMPK in 3T3-L1 adipocyte cell line, thus improving insulin sensitivity [15]. In addition, Sheng (2008) revealed that cinnamon extract (CE) is able to activate both PPARγ and PPARα, resulting in an improved insulin resistance, lower blood glucose, and lower serum lipid level without weight gain and a change in the structure of white adipose tissue [6]. As Tusara and Astuti (2013) reported, cinnamon extract is able to reduce the blood glucose of diabetic rats [16]. Elbidaway, et al (2013) also found that in obese rats, cinnamon has a positive effect on the blood glucose and HbA1C, leading to a decrease in insuAlin resistance as a result of an increase in the adiponectin level. In addition, Cinnamon Extract (CE) could improve the liver function in obese mice. CE may have potential in the management of obesity-related type two diabetes and hyperlipidemia [17].

IV.CONCLUSION

In summary, our research showed that steeping cinnamon at a dose of 150 mg/kg body weight could increase the level of adiponectin in Streptocozin-induced diabetic rats.

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