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Full Length Research Paper

The effect of cinnamon on glucose control in patients with type 2 diabetes mellitus in Pontianak, Indonesia

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The objective of this study was to examine pre- and post-glucose serum concentration levels in diabetes mellitus patients after the administration of cinnamon powder. A quasi-experimental design was done with 40 patients, with pre- and post-test non-equivalent control groups, without randomization. The first group was given a cinnamon powder extract solution to be taken 3 times per day and designated as the experimental group. The dose amounted to 3 g of cinnamon spread over the day, after breakfast, lunch, and dinner, respectively. The subjects were instructed to take the 3 g of cinnamon immediately following their meals. The patients with type 2 diabetes in the intervention group were aged 54.4 ± 8.7 years, and in the control group were aged 56.2 ± 10.5 years. There was a significant difference between the pre- and post-serum glucose concentration tests between the two groups. The measurements for the intervention group were 311.4 ± 96 and 185.8 ± 21, respectively (p = 0.000), while the control group pre-test was 277.1 ± 74, and the post-test was 205.3 ± 45 (p = 0.003). The results of this study demonstrated that intake of cinnamon reduces serum glucose in type 2 diabetes.

Key words: Cinnamon, diabetes mellitus, blood glucose.

INTRODUCTION

Based on current epidemiological research, the number of diabetic patients worldwide has reached 200 million and is estimated to increase to over 330 million by 2025. In 2000, approximately 8.4 million people suffered from diabetes in Indonesia, and by 2030 this number is estimated to reach about 21.3 million (Mishra et al., 2007; Wild et al., 2004). In Indonesia, Mihardja et al. (2009) found that the prevalence of diabetes was 5.7%, almost similar to the estimate by the International Diabetes Federation in 2003. The prevalence of diabetes mellitus was 6.4% in women and 4.9% in men. Prevalence increases with age, with a sharp rise from middle age (35 to 54 years).

Due to the increasing incidence of diabetes mellitus type 2, new sustainable treatments are greatly needed. Although currently, a number of effective Western diabetes mellitus medications are available for treatment, the management of diabetes mellitus using medications with fewer side effects at lower costs is still a big challenge (Wang et al., 2013). These medications frequently have side effects, such as weight gain, bone loss, and an increased risk of cardiovascular events (Prabhakar and Doble, 2011). These side effects can become more prevalent due to continued use. Furthermore, treatment is costly since diabetes mellitus is a chronic disease, and long-term medications are necessary. Herbal medications can be a good alternative to replace or at least supplement Western medications (Prabhakar and Doble, 2011; Li et al., 2004; Yang et al., 2011; Jia et al., 2003).

In Indonesia, several herbal medications have been proven to be clinically effective. Because herbal medicines are usually derived from natural plants, they are considered to be relatively safe and have fewer side

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Table 1. Characteristics of subjects.

Characteristic	Intervention group (n=20)	Control group (n=20)
Age (mean ± SD)	54.4±8.7	56.2±10.5
Sex n(%)		
Male	10(50)	7(35)
Female	10(50)	13(65)
Education n(%)		
Elementary	2(10)	10(50)
Junior High School	4(20)	3(15)
Senior High School	12(60)	4(20)
Higher Education	2(10)	3(15)

SD (standard deviation)

effects when compared to conventional drugs (Wang et al., 2013). Herbal medications treating diabetes mellitus can target multiple mechanisms, including the enhancement of insulin sensitivity, stimulation of insulin secretion, or a reduction of carbohydrate absorption (Prabhakar and Doble, 2011). Western drugs are typically more potent than herbal medicines in lowering blood glucose levels; however, herbal supplements have been shown to treat diabetic complications (Ceylan-Isik et al., 2008). Traditional plant remedies and herbal formulations have been in existence since ancient times and are still widely used, despite the controversy concerning their efficacy and safety (Fugh-Berman, 2000). Herbal medicine can also be used as supplementation, or in combination with Western medicine to improve therapeutic outcomes (Wang et al., 2013). In Indonesia, traditional medicine has long been used, over generations, for healing and disease prevention in the community.

In this study, we investigated one herbal remedy that is commonly used in Indonesia for controlling blood glucose, cinnamon, which is consumed with vegetables or as a beverage. Cinnamon has many pharmacological properties, such as antioxidants activity, antibacterial effects, natural insulin sensitizer and bioactive product that improve glucose and insulin metabolism (Hossein et al., 2012).

Diabetes mellitus patients require lifelong treatment and spend a large amount of money treating this disease. Cinnamon offers a promising solution as a traditional remedy and low-cost treatment. In Indonesia, no clear answer has been proven by several research studies, although some showed a relationship between cinnamon and blood sugar. The aim of this study was to examine pre- and post-glucose serum concentration levels in diabetes mellitus patients after the administration of cinnamon powder.

MATERIALS AND METHODS

The design of this study was a quasi-experimental non-randomized use, quota sampling method, which was selected to assess 20 patients from each group with pre- and post-test non-equivalent groups. This study was conducted at the Wound Clinic of Kitamura, Pontianak in Indonesia, from December, 2012 until February, 2013. The study population included all diabetes mellitus type 2 patients admited to the Wound Clinic, who were divided into two groups, an intervention group and a control group, with 20 subjects per group. Inclusion criteria included: (a) agreed to become a respondent, (b) diagnosed with diabetes mellitus, (c) routine out-patient, (d) age over 18 years, (e) not on insulin therapy, (f) not taking medicine for other health conditions, and (g) a fasting blood glucose level between 140 and 400 mg/dl. Selected subjects were given clear information regarding this study and asked to sign an informed consent after the explanation if they agreed to participate. The clinical research ethics committees of the Muhammadiyah Institute of Nursing, Pontianak, and Kitamura Clinic, Pontianak, Indonesia, approved the study protocol.

The first group was given a cinnamon powder extract solution to be taken 3 times per day and designated as the intervention group. The dose amounted to 3 g of cinnamon spread over the day, after breakfast, lunch, and dinner, respectively. The subjects were instructed to take the 3 g of cinnamon immediately following their meals. The serum glucose concentration was measured before and after cinnamon administration using the ACCU-CHEK Active (Roche Diagnostics, Germany, 2011). The cinnamon powder was administrated to the patients for 2 weeks; however, the serum glucose levels were taken before the administration of cinnamon in the first week and after consuming the cinnamon in the second week.

Extract preparation

The cinnamon powder extract solution processing was carried out at the Pharmaceutical Technology Laboratory, Department of Pharmacy, Faculty of Medicine, at the University of Tanjungpura. The cinnamon was finely ground into a powder. One preparation contained 3 g of cinnamon powder added to boiling water until reaching a full cup, and the cups were cooled and sealed with a cap to prevent essential oil evaporation. The subjects were asked to consume the clear upper part of the solution. Additionally, the subjects were advised to continue their normal diets and medications throughout the study.

Statistical analysis

This study used univariate and bivariate analyses with 95% confidentiality ($\alpha = 0.05$). The paired t-test was used to analyze the hypothesis with nominal and interval data. All data were analyzed using statistical package for social sciences (SPSS) version 17.0 (SPSS, Chicago, IL).

RESULTS

The subjects in the intervention group were aged 54.4 ± 8.7 years, and in the control group they were 56.2 ± 10.5 years (Table 1). A serum glucose concentration measurement was performed before and after administration of the cinnamon powder extract solution. The bivariate analysis with t-test results can be seen in Table 2. From the analysis, it is shown that a significant difference

Table 2. Comparison of means of blood glucose test patients pre- and post-intervention in the two groups.

Variables	Blood glucose Pre-test (n=20)	Blood glucose Post test (n=20)	Differences	t-test	P value
Control group	277.1 ± 74	205.3 ± 45	71.8±93	3.470	0.003
Intervention group	311.4 ± 96	185.8 ± 21	125.5±90	5.507	0.000

between the pre- and post- serum glocose concentration tests exists between the two groups. The measurements for the intervention group were 311.4 ± 96 and 185.8 ± 21, respectively (p = 0.000), while the control group pre-test was 277.1 ± 74, and the post-test was 205.3 ± 45 (p = 0.003). The difference in mean of pre- and post-tests in the control group was 71.8 ± 93, and in the intervention group it was 125.5 ± 90.

DISCUSSION

The aim of this study was to examine pre- and post-serum glucose concentration levels in diabetes mellitus patients after administration of cinnamon powder. This study found that there were significant decreases in the serum glucose tests between the two groups. The differences of pre- and post-intervention fasting glucose concentrations showed strong significance and a higher reduction in the cinnamon group than in the control group. The control group showed that blood glucose concentrations also decreased before and after administration of cinnamon. This condition may be caused by continuing their normal diets, activity, and medications. This study postulated that diabetes mellitus patients who consumed cinnamon powder decreased their serum glocose concentration, and the results confirmed a previous study which found that cinnamon reduced serum glucose levels in people with type 2 diabetes (Khan et al., 2003). Two studies reported that using 1 g cinnamon had no significant effect on the blood glucose of type 2 diabetics (Justin et al., 2007; Hasanzade et al., 2013), which were not similar to our study results.

In study of Hossein (2012), it was shown that 1.5 g of cinnamon supplementation for 8 weeks improve fasting blood glucose levels and lipid profiles in type 2 diabetic patients. One study reported that cinnamon consumption in doses of 1, 3, or 6 g daily for a period of 40 days led to a major reduction in fasting blood glucose, triglyceride, low-density lipoprotein (LDL), and total cholesterol levels (Khan et al., 2013). This study may conclude that a decrease in serum blood glucose will depend on the amount in grams given to patients with diabetes mellitus. The cinnamon does not contribute to caloric intake; those who have type 2 diabetes or those who have elevated glucose levels may benefit from the regular inclusion of cinnamon in their daily diets.

Khan et al. (2003) suggested that adding cinnamon to the daily diet of diabetes mellitus patients can reduce cardiovascular disease risks. Similar to Mang et al. (2006), the absolute and percentage differences between pre- and post-intervention serum fasting glucose levels of the cinnamon-supplemented and control groups were impressively significant.

This study demonstrated positive effect of cinnamon supplementation on decreasing blood glucose levels. Therefore, we conclude that regular use of cinnamon can promote healthy glucose metabolism, and cinnamon supplementation in type 2 diabetic patients could provide evidence for the beneficial effects some of biochemical actions. Adequate amounts of cinnamon possibly represent an effective means to reduce the risk factors associated with type 2 diabetic patients. If diabetes patients apply cinnamon in their food preparations regularly, they may keep their fasting blood sugar levels and lipid profiles near to normal levels.

Mang et al. (2006) suggested that cinnamon extract seems to have a moderate effect in lowering serum fasting glucose concentrations in glycemically controlled diabetes mellitus patients. Cinnamon extracts have also been shown to improve insulin receptor function by activating insulin receptor kinase and inhibiting insulin receptor phosphatase, leading to increase insulin sensitivity (Mahpara et al., 2004). One limitation of this study was that the study did not compare the doses between patients in the intervention group. Additionally, cinnamon supplementation and its effect on hemoglobin A1C (HBA1C) in diabetes mellitus II were not investigated. Therefore, future studies will address both limitations.

Conclusion

Given the discussion, we conclude that cinnamon powder extract solution may be consumed in diabetes mellitus patients to decrease serum glucose levels. However, we are not yet able to generalize the holistic conditions of the diabetes mellitus patients. We strongly suggest further research study into the proper cinnamon powder extract solution dose in patients with type II diabetes mellitus. It is also necessary to further explore these findings in all varieties of diabetes, including type I diabetes mellitus and gestational diabetes.

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