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# Impact of Short-Term Intake of Cinnamon on Serum Glucose and Lipid Profile in Patients with Type 2 Diabetes Mellitus

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## ABSTRACT

**Background/Objectives:** Several studies indicate that cinnamon can enhance insulin resistance and diminish blood glucose in patients with diabetes mellitus. Concerns about the increasing rate of diabetes incidence worldwide are developing and using whether alternative treatment or supplementation such as botanical supplements would be beneficial. Furthermore, the existing studies in this regard are controversial. Therefore the aim of this study was to investigate the effect of cinnamon supplementation on fasting blood glucose and lipid profile in individuals with type 2 diabetes.
**Subjects/Methods:** In this randomized double blind intervention study 50 individuals with type 2 diabetes (25 subjects as intervention group and 25 subjects as control group) were recruited from diabetes clinic of Golestan Hospital in Ahvaz, Iran. Individuals in the intervention group received 3 g/d cinnamon supplement as capsulated powder (500 mg) for 60 days and individuals in the control group consumed 3 g/d wheat flour as placebo for 60 days. Blood samples were collected pre and post intervention. Fasting blood glucose, triglyceride, total cholesterol, LDL-C, HDL-C and VLDL were measured.
**Results:** In the intervention group HDL-c was increased and the levels of other indices were significantly decreased post intervention, but it was not significant for LDL-c. In the control group total cholesterol and LDL-c levels were decreased, but not significantly and TG and VLDL levels were significantly increased. The levels of indices except for HDL-c were not significantly different between intervention and control group in women.
**Conclusion:** Cinnamon intake with efficient dosage may improve blood glucose and lipid profile in patients with diabetes and therefore may be a suggested approach to control this disease and its complications.
**KEYWORDS:** Cinnamon; Lipid profile; Blood glucose; Diabetes mellitus

## INTRODUCTION

Diabetes Mellitus is a complicated metabolic disorder accompanied with either impairment of insulin sensitivity in visceral tissues such as skeletal muscles or lack of insulin secretion [1]. According to the reports of Iranian Diabetic Center, 2.5 million people are suffering from diabetes mellitus [2]. This disease has serious and considerable impacts on human health, life quality, and life expectancy and health care systems [3]. There are several approaches used in the treatment of this disease including lifestyle change as increasing physical activity, weight management, improving diet, oral medications to reduce blood glucose and insulin injection [4]. In recent years, several studies are increasingly developed to find new alternative treatment methods such as using food additives like cinnamon in order to control insulin resistance and diabetes mellitus [5]. Cinnamon, which is also called as Cassia, sweet wood and Gui Zhi, is an old botanical medication cultivated and used traditionally in Asian countries [6, 7]. Several studies have reported some beneficial effects for cinnamon such as its antioxidant, anti inflammatory and antibacterial effects [8]. Moreover, other useful effects including vasodilator, anti thrombosis, anti spasm, and anti allergy have also been indicated for cinnamon extract [7]. There are several compounds reported in cinnamon including cinnamaldehyde, eugenol, camphor, polyphenols and trace elements such as calcium, chrome, copper, iodide, iron, magnesium, phosphorous, potassium and zinc, however, it is suggested that its beneficial effects are related to its flavonoids [8]. The interests toward using cinnamon as an appropriate cure for the treatment of type 2 diabetes mellitus has been developed since finding its improving impact on insulin sensitivity about 25 years ago [9]. Several in vitro studies indicated that cinnamon could act like insulin and improve glucose utilization in the cells [9-13]. Some in vivo studies such as the study carried out by Mang and coworkers [14] showed significant reduction in fasting blood glucose in patients with

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type 2 diabetes mellitus who consumed 3 g/d cinnamon for 120 days. Crawford and coworkers study [15] also showed lower HbA1c after receiving 1 g/d cinnamon. Furthermore, some investigations have found the inhibition of liver HMG-CoA reductase and decreased lipid profile in animal and human in response to cinnamon extract intake. According to Khan and coworkers [16] serum glucose, triglyceride, LDL-c, total-c were reduced post consuming of cinnamon [16]. However, the findings of clinical studies on cinnamon are controversial. For example Blevins and et al [17] did not find any significant effects on blood glucose and lipid profile after consuming 1 g/d cinnamon for 90 days in patients with type 2 diabetes mellitus. Therefore, the aim of this study was to investigate the effects of supplementation with cinnamon powder on blood glucose and lipid profile in patients with type 2 diabetes mellitus.

## MATERIALS AND METHODS

This double blind randomized clinical trial was carried out in patients with type 2 diabetes mellitus in Diabetes Center of Golestan hospital in Ahvaz. The ethic's approval was obtained from the Ethic Committee of Ahvaz Jundishapur Medical University. The main inclusion criteria included age older than 40 y both genders, fasting blood glucose ranged from 140 – 400 mg/dl and exclusion criteria were using insulin therapy and using other medications except for blood glucose lowering drugs. The participants were informed of this study and consent form was obtained. A total of 50 subjects (28 female and 22 male) were equally divided into two groups of intervention, receiving cinnamon supplement, and control group, receiving placebo. 10-12 hours of fasting blood samples were collected before and after intervention and biochemical indices composed of fasting blood glucose, serum triglyceride, total cholesterol, LDL-c, VLDL-c and HDL-c were measured. All biochemical indices were measured by enzymatic method using commercial kit (Pars Azmoon) with Selectra 2 – Autoanalyzer. The subjects in the intervention group consumed 3 g/d cinnamon as 500 mg capsules (3 times every day, two with each meal) and subjects in the control group received 3 g/d wheat flour as placebo for 60 days. Cinnamon wood was purchased from local herbal market in Abadan and milled and prepared as capsules in pharmacological faculty of Ahvaz Jundishapur Medical Sciences University. The placebo capsules were also prepared with the same features as cinnamon capsule. All subjects used their usual medications counseling with their consultant.

## RESULTS

During this study 3 people were withdrawn. The mean age of all subjects (20 male and 27 female) in the intervention and control groups were respectively 52.0 ±6.87 and 52.0 ± 5.8 y, which the difference was not significant. All subjects reported using similar medications, which it was metformin. Table 1 and 2 show the status of blood glucose and lipid profile in the intervention and control groups' pre and post intervention. In the intervention group the HDL-c level was significantly raised and other biochemical indices except for LDL-c were significantly lowered post intervention.

**Table 1: Mean and standard deviation of biochemical indices in intervention group before and post intervention**

| Biochemical indices | Before Intervention | Post Intervention | P |
|---|---|---|---|
| **FBS (mg/dl)** | 187.2 ± 63.2 | 155.7 ± 51.6 | < 0.001 |
| **TG (mg/dl)** | 215.2 ± 99.5 | 182.0 ±88.4 | < 0.001 |
| **TC (mg/dl)** | 238.7 ± 42.7 | 214.6 ± 35.0 | < 0.017 |
| **LDL (mg/dl)** | 136.1 ±52.2 | 121.7 ± 42.9 | < 0.051 |
| **VLDL (mg/dl)** | 42.9 ± 19.8 | 36.0 ± 17.6 | < 0.001 |
| **HDL (mg/dl)** | 58.7 ± 21.9 | 64.3 ± 16.7 | < 0.593 |

**Table 2: Mean and standard deviation of biochemical indices in control group before and post consumption of placebo**

| Biochemical indices | Before Placebo | Post Placebo | P |
|---|---|---|---|
| **FBS (mg/dl)** | 154.3 ± 129.0 | 163.8 ± 8.67 | < 0.005 |
| **TG (mg/dl)** | 209.1 ± 99.5 | 251.7 ±160.9 | < 0.001 |
| **TC (mg/dl)** | 244.1 ± 58.6 | 238.6 ± 61.6 | < 0.015 |
| **LDL (mg/dl)** | 138.4 ±49.0 | 125.3 ± 58.0 | < 0.001 |
| **VLDL (mg/dl)** | 41.5 ± 25.8 | 50.3 ± 32.2 | < 0.001 |
| **HDL (mg/dl)** | 51.5 ± 13.6 | 51.6 ± 11.0 | < 0.322 |

While, in the control group only the levels of total-c and LDL-c were decreased although not significantly and the mean of other parameters were increased, which it was significant for triglyceride and VLDL. The mean levels of fasting blood glucose, triglyceride, and VLDL-c were significantly reduced among men in the intervention group post intervention. Moreover, total-c level was also reduced in this group, but not

significantly. Furthermore, the mean levels of HDL-c and LDL-c were increased among men in this group. Among women in the intervention group it was found that only HDL-c was significantly increased and the reduction in the level of total-c was not significant. There were no significant differences found between groups among either gender except for HDL-c, which was higher among women in the intervention group (Data were not shown).

## DISCUSSION

It is indicated that lipid aggregation in visceral tissues such as skeletal muscles and adipose tissue can lead to insulin resistance, blood glucose elevation and consequently impairment in glucose tolerance and diabetes mellitus [18,19, 20]. On the other hand the insulin resistance can result in excessive production of VLDL-c and limited lipoprotein lipase activity and therefore causing dyslipidemia [14]. The effects of cinnamon on blood glucose have been investigated in several in vitro and in vivo studies; however, there is limited number of controversial studies investigating its impact on serum lipid profile. In this study aiming to probe the influence of consuming cinnamon powder on both fasting blood glucose and serum lipid profile it was found that receiving 3 g/d cinnamon for 60 days could significantly improve some biochemical indices of fasting blood glucose (10.7 %) and lipid profile (TG: 14.5 % , total-c: 10.3 %, VLDL: 15.3 %) post intervention. However, these changes were not significant between groups except for the levels of HDL-c among women and it may be due to higher number of female subjects compared with males. According to Khadem and coworkers [21] study carried out in 60 patients with type 2 diabetes mellitus consuming 1.5 g/d cinnamon powder for 60 days could reduce the mean of fasting blood glucose, glycated hemoglobin and insulin resistance. Furthermore, another study by Vafa and et al [22]which investigated the impact of receiving 3 g/d cinnamon for 8 weeks in 44 patients with type 2 diabetes mellitus, it was found that the levels of fasting blood glucose, HbA1c, TG, body weight and BMI were significantly lowered post intervention, however, the differences between groups were not significant which concur with the findings of our study.

Cinnamon contains some polyphenols, which are able to improve glucose uptake into the cells and insulin sensitivity. There are some possible mechanisms suggested for the action of cinnamon polyphenols mainly including: improving insulin message transduction route through the elevation of spontaneously phosphorylation of insulin receptor, elevation of ß receptor (IR- ß), elevation of substrate for insulin-1 receptor (IRS-1), GLUT 4 enhancement and as a result increasing glucose removal and glycogen synthesis through the activation of glycogen synthase and inhibition of glycogen synthase kinase ß. Additionally, some studies suggesting the effect of cinnamon water extract on some replication agents such as peroxisome proliferator activated receptors (PPARs) involved in adipogenesis and insulin resistance. According to one meta analysis study [8] Davis and coworkers showed that cinnamon could reduce fasting blood glucose. Moreover, in a review study Countier and et al [23] indicated that the beneficial effects of cinnamon in vitro on insulin resistance could result from improving insulin sensitivity and body composition. However, another meta analysis by Baker and coworkers [24] did not show such significant effects of cinnamon on fasting blood glucose, HbA1c and lipid profile. So, this is the controversial issue to show the importance of further investigations.

The main limitation of this study was the lack of dietary intake data in subjects pre and post intervention and its association with biochemical and anthropometric indices, the usage dose and short term cinnamon consumption.

### Conclusion

The results of this study suggest that daily using of cinnamon with a safe and influent dosage may reduce important indicators in the management of type 2 diabetes mellitus and its complications.

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The authors declare that they have no conflicts of interest in the research.

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