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Full Length Research Paper

Effects of cinnamon on blood glucose and lipids levels in diabetic patients (Type1)

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The present study was designed to investigate the effects of supplementation of cinnamon on blood glucose and lipids levels among type1 diabetics. The samples consisted of 60 subjects with type1 diabetes and the doses of cinnamon were equally administered orally in the form of capsules with breakfast, lunch and dinner. The doses were given for 4 weeks. Blood samples were taken on the starting day of the experiment and at the end of 4 weeks. The fasting blood glucose and lipids levels of types1 were determined, from the results obtained the mean value of fasting blood glucose levels for cinnamon doses on the starting day, was found to be 241.5 mg/dl and the mean values for lipids were triglyceride (225.5 mg/dl), total cholesterol (300 mg/dl) and low-density lipoprotein (LDL) (165.7 mg/dl). When the diabetic individuals used the doses of cinnamon for 4 weeks, their mean fasting blood glucose level dropped to 126.67 mg/dl, triglycerides (150 mg/dl), total cholesterol (210 mg/dl) and LDL (115.5 mg/dl). The reduction in the mean fasting blood glucose and lipids levels were significant at $P < 0.001$ and $P < 0.05$ respectively.

Key words: Cinnamon, blood glucose, lipids level, type1 diabetes.

INTRODUCTION

Diabetes is still a serious health problem all over the world. It is considered the most common metabolic disease worldwide, with an estimated 1700 new cases diagnosed daily. The W.H.O. estimate of diabetes prevalence for all age-groups worldwide was 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030 (Wild et al., 2004). Because the disease prevails in both genders and all age groups so, the general public has a concern about its control and treatment. In addition to drug treatment, dietary interventions were shown to represent an effective tool to prevent and/or treat insulin resistance (Jenkins et al., 2002; Willett et al., 2002). Spices like cinnamon, cloves, bay leaves and turmeric have insulin-potentiating effect *in vitro* (Khan et al., 1990).

A number of spices and herbs have a long history of traditional use in treating elevated blood sugar levels. One such compound that has recently been the subject of intense research is cinnamon, a compound granted GRAS (Generally Recognized as Safe) status by the United States Food and Drug Administration. Cinnamon has been shown to be generally safe when ingested and to have many pharmacological properties, such as antioxidants activity and antibacterial effects (Lopez et al., 2005; Jellin, 2006). In ancient Egypt, cinnamon was used as a medicine and an embalming agent and at times it was even considered more precious than gold. It was also popular in China and is mentioned in one of the earliest books on Chinese botanical medicine (Charles, 1998). Today cinnamon is widely used in Ayurvedic medicine (traditional Indian medicine) to treat diabetes in India. Recently Anderson and his team discovered the scientific evidence that demonstrates how cinnamon seves as an important antioxidant and is beneficial in the prevention and control of glucose intolerance and diabetes (Anderson et al., 2004).

Over the past 2 decades, *in vitro* and *in vivo* data have been accumulating which support the role of cinnamon on glycemic control. For example, Jarvill-Taylor et al., 2001) reported that cinnamon stimulated glucose uptake, glycogen synthesis and activated glycogen synthase in 3T3-L1 adipocytes. In rats, cinnamon enhanced glucose uptake by enhancing insulin-stimulated tyrosine phosphorylation of insulin receptor- , insulin receptor substrate-1, and phosphatidylinositol 3-kinase in a dose-dependent fashion (Qin et al., 2003, 2004).

Some even achieved normal blood sugar levels. Blood sugar started creeping up again after the diabetics

Table 1. Demographic characteristics of Type 1 diabetes.

Male	35(58.3%)
Female	25(41.7%)
Age	50 (SD±10)
Employed	38(63.3%)
Unemployed	22(36.7%)
Single	7(11.7%)
Married	53(88.3%)
Length of time since diabetes	10 (SD±7)

patients stopped taking cinnamon. Altschuler et al. (2007) and Solomon et al. 2007 have investigated the impact of cinnamon on glucose and plasma lipid concentrations in patients with diabetes but yielded conflicting results and had modest sample sizes. These findings led to widespread cinnamon use, although no study had yet evaluated the effects of cinnamon in Arab diabetic populations with likely differences in diet, BMI, baseline glucose levels and prescribed medication. Moreover, the efficacy of cinnamon in patients with type 1 diabetes has not been established, many patients seek other therapies and supplement their prescribed pharmacologic therapy with cinnamon. Therefore, we report the first Arab study examining the effects of cinnamon on glucose levels in subjects with type 1 diabetes.

MATERIALS AND METHODS

Data collection

A pre/post test randomized study design and utilized to show the impact of cinnamon supplementation on blood glucose and lipids levels among type1 diabetic. Then comparison between 2 results to improved the effects of cinnamon on blood glucose and lipids levels. The study was conducted in Al Mafraq Governmental Hospital in Jordan

60 individuals with type1 diabetes of both sexes (35 males and 25 females) of age 40 years or older were recruited for participating in the current study. Only those diabetic subjects, who were not taking medicine for other health conditions and whose fasting blood glucose were in the range of 160 – 400 mg/dl and high lipids level were included in the study. The study was approved by medical ethical committee of the Zarqa private university. Data for the present study were collected through utilizing the following tools, 1-demographic data sheet was developed by the research. It included background characteristics of patients, such as age, year of graduation, employment, length of time since diabetes and type of education (secondary school degree or technical institute degree). Fasting blood glucose and lipids level were measured at baseline starting day and at the end of the week 4.

The study was conducted for 4 weeks. Type 1 diabetic individuals were allowed to take their routine diet and usual diabetic medicine. The individuals were told to take 4 capsules of whole cinnamon powder immediate after breakfast, lunch and dinner for 4 weeks each capsules contain (500 mg) that means 6 g per day, these capsules were prepared by technician of the local pharmacy. The research did not suggest any alterations in other aspects of the subject's medical care, diet, or exercise. Compliance was monitored by contact with the subjects.

Biochemical analysis

Biochemical analysis done by collection of blood samples approximately 10 ml blood samples were taken before breakfast from the vein directly into lithium heparin vacuum tubes for measurements of fasting blood glucose level, triglyceride, total cholesterol and LDL. The samples were centrifuged within 1 h at 1000 x g for 10 min at 4°C, the plasma transferred into separate labeled tubes and transferred immediately by cold boxes filled with ice to the central laboratory of the Mafraq Hospital. All biochemical measurements were carried out by the same team of laboratory technicians using an auto analyzer (Dimension RXL clinical chemistry system, Dade Behring, USA) each individual on the starting day and at end of week 4.

Prior to implementation of the training program, an official permission was obtained from the supervisors of the selected units. This was intended to facilitate data collection and to explain study purpose. At the beginning of the study, participants' were invited to participate in the study. The researcher explained the study purpose and procedures for the randomly selected sample. Potential subjects were further informed that the participation was voluntary and that study findings would be presented group wise and no individual would be recognized.

Statistical analysis

Collected data were tabulated and needed statistical analyses were done using descriptive statistic, means and standard deviation (SD) of the means were calculated utilizing the computer data processing (SPSS, version 12). A probability value (P) of < 0.05 was considered to be statistically significant.

RESULTS

60 subjects of type 1 diabetes were randomized into the study their demographic characteristics shown in the Table 1. The samples had a mean age of 50 years (SD ± 10). 35 patients (58.3%) were male and 22 (36.7%) were unemployed or retired. The majority were married (88.3%). The mean length of time since diabetes was diagnosed was 10 years (SD ± 7).

Repeated measure ANOVA was used to assess the effectiveness of cinnamon among type1 diabetic individuals by examining fasting blood glucose and lipid levels changes across time is shown in Table 2. The fasting blood glucose and lipids values on the starting day indicate of diabetic individuals before the start of cinnamon. So these values levels were the control for the study.

On the starting day of the experiment (day 0), the mean fasting blood glucose levels of the diabetic individuals, were (241.5 mg/dl). Triglyceride (225.5 mg/dl), Total cholesterol (300 mg/dl) and LDL (165.7 mg/dl). When the diabetic individuals used the doses of cinnamon (6 g) for 4 weeks, their mean fasting blood glucose levels dropped to (126.67 mg/dl) means (48%), triglyceride (150 mg/dl) (36%), total cholesterol (210 mg/dl) (30%) and LDL (115.5 mg/dl) (30%) . The reduction in the mean fasting blood glucose levels and lipid levels were significant at ($p < 0.001$) and ($P < 0.05$) respectively. This conclusion was supported by the repeated measure ANOVA (F) test.

Table 2. Effect of cinnamon on fasting blood glucose and lipid levels of the Type 1 diabetic.

Test	Starting day	After 4 weeks	% of reduction
	Mean± SD(mg/dl)	Mean ± SD(mg/dl)	
(FBG)	241.5 ± 36.70	126.67 ± 6.9**	48
Triglyceride	225.5 ± 20.65	150 ± 5.2*	36
Cholesterol	300 ± 30.20	210 ± 8.5*	
LDL	165.7 ± 22.30	115.5 ± 7.1*	

** (p<.001). *(P<0.05)

DISCUSSION

This is the first Middle east study to evaluate the effects of cinnamon on blood glucose and lipid levels in individuals with type1 diabetes.

A number of spices and herbs have a long history of traditional use in treating elevated blood sugar levels (Broadhurst et al., 2000). One such compound that has recently been the subject of intense research is cinnamon. Over the past 2 decades, *in vitro* and *in vivo* data have been accumulating which support the role of cinnamon on glycemic control.

In the present study, we investigated the effects of cinnamon on type 1 diabetic individuals when consumed (6 g/d) of cinnamon for 4 weeks we observed lowering the mean fasting blood glucose levels (48%) were significantly at ($P < 0.001$) as compared to their mean corresponding blood glucose values at the start of the experiment (day 0),and also lower the mean of triglyceride (36%), LDL (30%) and total cholesterol (30%) were significantly at ($P < 0.05$) .

Recently, Khan et al. (2003) presented the first data on the effects of cinnamon supplementation *in vivo* in humans. In their study, 10 patients with diabetes consumed 1, 3, or 6 g of cinnamon or placebo daily for a period of 40 days. Cinnamon consumption led to a major reduction in fasting serum glucose (18 - 29%), triglyceride (23 - 30%), LDL (7 - 27%) and total cholesterol (12–26%) concentrations in each of the cinnamon supplementation trials. The present study shows that 4 weeks of cinnamon supplementation does improve triglyceride, LDL and total cholesterol. Consequently, the authors concluded that small amounts of cinnamon likely represent a safe and effective means to reduce the risk factors for the development of co-morbidities associated with diabetes.

This trend was justified as cinnamon was potentiating the function of insulin in carbohydrate metabolism. Khan et al. (1990) have reported that an unidentified factor is present in cinnamon that potentiates the action of insulin in carbohydrate metabolism. They termed this factor as insulin potentiating factor (IPF). Broadhurst et al. (2000) reconfirmed the presence of this factor in cinnamon. This hypoglycemic effect of cinnamon may or may not be like other hypoglycemic drugs. This unidentified factor increased the activity of insulin 3 fold in glucose metabolism in rat epididymal rat fat cell. Anderson et al. (2006) characterized this unidentified factor present in cinnamon as methylehydroxy chalcone polymers (MHCP). They explained that MHCP made fat cells more responsive to insulin by activating the enzyme that causes insulin to bind to cells (insulin-receptorkinase) and inhibiting the enzyme that blocks this process (insulin-receptor- phosphatase) leading to maximal phosphorylation of the insulin receptor, which is associated with increased insulin sensitivity.

Moreover, the mean fasting blood glucose and lipids levels (triglyceride, LDL and total cholesterol) of diabetic individuals were significantly at $p < 0.001$ and $P < 0.05$ respectively, when they used cinnamon doses for 4 weeks. The improvement in glucose regulation observed in this study was significant in and of itself, but it was also significant vis-à-vis the results of other studies of a similar nature. Ziegenfuss et al. (2006) trial with diabetic adults in Germany, showed less pronounced, but still notewor-thy, results with a water-soluble cinnamon extract that was equivalent to 3 g/day of whole cinnamon powder. Their findings indicate that consuming cinnamon for 12 weeks leads to significant improvements in several fea-tures of the metabolic syndrome.

A more recent study carried by researchers at University of Lund in Sweden used a crossover trial to study the effects of cinnamon on the gastric emptying time and blood glucose levels. They found that volunteers who ate rice pudding with cinnamon had far slower gastric emptying times than those who ate the rice pudding without cinnamon. In addition, those in the cinnamon group did not have the rapid rise in blood glucose levels that those in the plain rice pudding group experienced. Mourot et al. (2007). They concluded that cinnamon could reduce the sudden rise in blood glucose levels and metabolic syndrome, and this could be achieved by delaying the emptying of the stomach contents into the small intestine.

Moreover, Altschuler et al. (2007) explained their negative results in the light of mechanistic differences between type 1 and 2 diabetes, that is, the lack of endogenous insulin production in the former. Kim et al. (2006) were the first to suggest that cinnamon may act by stimulating endogenous insulin production. If this were true, it would explain our results. However, this contention does not fit well with the majority of published research, which instead suggests a mechanism focused on the insulin receptor. Altschuler et al. (2007) attributed their negative results

among type 1 diabetics to the fact that their subjects received an inadequate dose of cinnamon 1 g/day. Vanschoonbeek et al. (2006) used 1.5 g/day and failed to demonstrate a benefit. Moreover, Altschuler et al. (2007) further added that it is also possible that participants were not given cinnamon for a long enough duration. Because 90 days is less than the full 120 days lifespan of red blood cells, perhaps this shorter duration contributed to a false-negative result.

In summary, this study provides evidence that cinnamon is effective in decreasing glucose level and lipids level among Type 1 diabetic individuals. Coupled with other recent research, our results demonstrate positive effect on decreasing fasting blood glucose and lipids level introduces significant remarks regarding the efficacy of cinnamon in diabetic subjects. In the light of this research, it is recommended that diabetic individuals should use cinnamon in their food preparations on regular basis. This will keep their sugar level and lipids level near to normal values.

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