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Effects of Cinnamon on Blood Glucose and Lipids Levels in Diabetic Patients (Type2)

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Abstract

The present study was designed to investigate the effects of supplementation of cinnamon on levels of blood glucose and lipids among type 2 diabetics. The samples consisted of 75 subjects of both sexes (40 males and 35 females) with type 2 diabetes, and the doses of cinnamon 6g 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 types 2 subjetcs were determined. From the results obtained, the mean value of fasting blood glucose level on the starting day before cinnamon intake was found to be 210.5mg/dl, and the mean values for lipids were triglyceride (205.5mg/dl), total cholesterol (290 mg/dl) and low-density lipoprotein (LDL) (170mg/dl). When diabetic subjects consumed the dose of cinnamon for 4 weeks, their mean fasting blood glucose level dropped to 120.5 mg/dl, triglycerides (160.2 mg/dl), total cholesterol (215.4 mg/dl) and LDL (122.5 mg/dl). The reduction in the mean fasting blood glucose and lipids levels were significant at $P<0.001$ and $P<0.05$, respectively. Conclusion: This study provides evidence that cinnamon is effective in decreasing glucose level and lipids level among type 2 diabetic individuals.

الملخص

إن الدراسة الحالية صممت حتى تتحقق من تأثير القرفة في نسبة السكر والدهون في الدم لمرضى السكري نوع 2.
شملت الدراسة 75 مريض سكري نوع 2 من كلا الجنسين(35 انثى و40 ذكر) تم إعطاؤهم جرعة مقدارها 6غم على شكل كبسولات مع الفطور والغداء وكذلك العشاء, وهذه الجرعة أعطيت لمدة أربع أسابيع, حيث تم أخذ عينة من الدم في اليوم الأول قبل اعطائم القرفة وكذلك عينة أخرى في نهاية الأسبوع الرابع، حيث تم فحص مستوى السكر والدهون لمرضى السكري نوع 2 وتم تحليل النتائج باستخدام برنامج إحصائي.
كانت النتائج كتالي الوسط الحسابي لمستوى السكر في بداية استخدام القرفة كان 210,5 وكان الوسط الحسابي لشحوم الثلاثية 205.5 والكوليسترول 290 والبوتينات الشحمية منخفضة الكثافة 170 وعندما استخدم المرضى القرفة لمدة أربع أسابيع كان الوسط الحسابي للسكر 120.5 ولشحوم الثلاثية 162.2 والكوليسترول 215.4 والبوتينات الشحمية منخفضة 122.5 . وكان النزول في السكر ذو أهمية $P < 0,001$ و الدهون $P <0,05$.

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Keywords: Cinnamon , Blood Glucose, Lipids Level, Type 2 Diabetes.

1. Introduction

During 2004, approximately 400,000 (15%) Jordanian adults had diabetes (increasing 7% than in 1996), and an estimated 350,000 (12%) had impaired fasting glucose, and approximately 23% had high blood cholesterol — an increase from 9% in 1996.(Mokdad AH.2007 and Zindah M *et al.* 2004)

Diabetes mellitus is a chronic disorder of glucose metabolism resulting from dysfunction of pancreatic beta cells and insulin resistance. It is still a serious global health problem. The disease prevails in both genders and all age groups, so the general public has a concern about its control and treatment. Botanical products can improve glucose metabolism and overall condition of persons with diabetes not only by hypoglycemic effect, but also by improving lipid metabolism, antioxidant status, and capillary function (Broadhurst, 1997). (Broadhurst *et al.* 2000) and (Jarvill etal.,2001) re-evaluated the extract of cinnamon on insulin function in the insulin-dependent utilization of glucose using a rat epididymal adipocyte assay.

Cinnamon was the most bioactive product. The glucose oxidation enhancing bioactivity was lost from cinnamon

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by polyvinylpyrrolidone (PVP) treatment, indicating that the active phytochemical were likely to be phenolic in nature. They concluded that the extract of cinnamon had improved the glucose and insulin metabolism.

However, those studies were conducted *in vitro*. There is a general view that the results of animal studies may not be applied to human. Therefore, this study was designed to see the effect of cinnamon on blood glucose in Type 2 diabetic individuals.

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).

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 has yet evaluated the effects of cinnamon in Arab diabetic populations with likely differences in diet, Body Mass Index (BMI), baseline glucose levels, and prescribed medication. Therefore, report here the first Arab study examining the effects of cinnamon on glucose and lipids levels in subjects with type 2 diabetes.

2. Materials and Methods

2.1. Data Collection

The study design was utilized to show the impact of cinnamon supplementation on blood glucose and lipids level among type 2 diabetic. The study was conducted in Jordan at Al Mafraq Governmental Hospital; from January 2008 to March 2009

Seventy five individuals with type2 diabetes of both sexes (40 males and 35 females) of age 40 years or older were recruited for participating in the current study. Only those diabetic subjects using Glibenclamide drug and who were not taking medicine for other health conditions and whose fasting blood glucose were in the range of 160-300mg/dl, and subjects with 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:

Fasting Blood Glucose and lipids level were measured two times once at baseline before cinnamon intake (as a control) and the second measured after cinnamon intake for 4 weeks.

The treatment was conducted for 4 weeks. Type 2 diabetic individuals were allowed to take their routine diet and usual diabetic medicine. The individuals were told to take 4 capsules each (500mg) 2g of whole cinnamon powder immediately after breakfast, lunch and dinner for 4 weeks. 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.

2.2. Biochemical Analysis

Biochemical analysis was done by collection of blood samples, approximately 7ml 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 on the starting day and at end of week 4. The samples were transferred into the laboratory of the Zarqa Private University. All biochemical measurements were carried out by the same team of laboratory technicians.

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.

2.3. 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.

3. Results

Seventy five subjects of type 2 diabetes were randomized into the study. The sample had a mean age of 59 years (SD = 10) with 40 (53.3%) patients aged ≤ 60 years and Thirty-five patients (46.7%) > 60. The males were 40 subjects (53%) and female subjects were 35(47%). The mean length of time since diabetes was diagnosed was 16 years (SD = 9).

Repeated measure ANOVA was used to assess the effectiveness of Cinnamon among type 2 diabetic individuals by examining blood glucose and lipid levels changes across the time between starting day and end of week 4.

The effect of cinnamon on FBG levels and lipid levels of diabetic individual is shown in table 1. The FBG and lipid levels values on day 0 indicate the FBG and lipid levels of diabetic individuals before the start of cinnamon intake. So these levels were the control values for the study.

Table 1. Fasting Blood Glucose and lipids levels for Type 2 Diabetic Study Participants.

Test	before cinnamon intake	after cinnamon intake	Percentage of reduction
	Mean± SD(mg/dl)	Mean± SD(mg/dl)	%
Baseline (FBG)	210.5 ± 33.70	120.5 ± 6.9*	47%
Triglyceride	205.5 ± 22.65	160.2 ± 5.2*	22%
Cholesterol	290 ±25.50	215.4 ± 8.5*	26%
LDL	170 ± 20.30	122.5 ± 7.1*	28%

* Significant at ($P<0.05$)

(FBG) fast blood glucose, LDL- low- density lipoprotein On the starting day of the experiment (day 0), the mean FBG level of the diabetic individuals was 210.5 mg/dl, and lipid level of Triglyceride was 205.5 mg/dl, Cholesterol 290 mg/dl , LDL 170 mg/dl. When the diabetic individuals of these groups used the doses of

cinnamon for 4 weeks, their mean FBG dropped to 120.5 mg/dl and lipid levels Triglyceride dropped to 160.2 mg/dl, Cholesterol dropped to 215.4 mg/dl , LDL dropped to 122.5 mg/dl. The reduction in the mean FBG and lipid levels were significant at ($P<0.05$). This conclusion was supported by the repeated measure ANOVA (F) test.

4. Discussion

Human studies demonstrating beneficial effects of cinnamon supplementation on glucose regulation have examined subjects with type 2 diabetes (Khan *et al,* 2003; Mang *et al.* 2006). The present study shows that 4 weeks of cinnamon supplementation does improve plasma glucose and lipids levels in patients with type 2 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 two decades, in *vitro* and in *vivo* data have been accumulating and supporting the role of cinnamon on glycemic control.

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 type 2 diabetes (aged 52.2 ± 6.3 y) 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%), reduction in triglyceride (23–30%), reduction in 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.

In the present study, we investigated the effects of short-cinnamon use (6 g/d) on fasting blood glucose. Consumption of cinnamon for 4 weeks significantly at ($P <0.001$) lowered the mean fasting blood glucose levels(47%) of diabetic individual as compared to their mean corresponding blood glucose values at the start of the experiment (day 0), and also lower the mean of triglyceride(22%), LDL(28%), and total cholesterol(26%).

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.

Ziegenfuss *et al,*(2006) trial with diabetic adults in Germany showed less pronounced, but still noteworthy, 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 features of the metabolic syndrome (i.e., fasting blood sugar, systolic blood pressure, and body composition).

Previously shown trials revealed a marked insulin-mimetic effect of cinnamon powder, resulting in improved blood glucose regulation. Other trials showed somewhat different results, and sometimes to contradictory results, matters that may depend on how the many variables involved affect one another. Vanschoonbeek *et al.*(2006) reported no effect of 1.5 g/d x 6 weeks cinnamon powder on indices of glycemic control in 25 postmenopausal women from the Netherlands. This study is different from that of Khan *et al.* (2003) and Mang *et al.*(2006), as well as the current study, in that only postmenopausal females were included as subjects. Whether differences in hormonal affect the potential interaction between cinnamon supplementation and glucose control is unknown at this time.

Moreover, Altschuler *et al.* (2007) explained their negative results in the light of mechanistic differences between type 1 and type 2 diabetes, i.e., the lack of endogenous insulin production in the former. They were the first to suggest that cinnamon may act by stimulating endogenous insulin production. If this was 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. 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-day lifespan of red blood cells, perhaps this shorter duration contributed to a false-negative result. However, we believe that 90 days is a sufficient time in which to demonstrate an effect, and also pointed out that these results are consistent with other recent observations (Mang *et al.* 2006.; Vanschoonbeek *et al,* 2006).

In summary, this study provides evidence that cinnamon is effective in decreasing glucose level and lipids level among type 2 diabetic individuals. Coupled with other recent research, our results demonstrate positive effect on decreasing fasting blood glucose and lipids levels , it 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 levels near to normal values.

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References

Altschuler JA, Casella SJ, MacKenzie TA, and Curtis KM. (2007). The Effect of Cinnamon on A1C Among Adolescents With Type 1 Diabetes. Diabetes Care. 30:813-816.

Anderson RA, Broadhurst CL, and Polansky MM, (2006). Isolation and characterization of chalcone polymers from cinnamon with insulin like biological activities. American Journal of Clinical Nutrition. 84(3): 1432-1436.

Broadhurst CL, Polansky M.M, and Anderson RA.(2000). Insulin-like biological activity of culinary and medicinal plants aqueous extracts in vitro. J. Agri. Food Chem. 48: 849-852.

Broadhurst, C.L., 1997. Nutrition and non-insulin dependent diabetes from an anthropological perspective. Alt. Med. Rev., 2: 378-399.

Jarvill-Taylor KJ, Anderson RA, and Graves DJ. (2001). A hydroxy chalcone derived from cinnamon functions as a mimetic for insulin in 3T3-L1 adipocytes. J. ACN. 20: 327-336.

Jellin JM. Cassia cinnamon– Monograph (online). [cited 2006]; Available from http://naturaldatabase.com [accessed 30 august 2006].

Khan A, Bryden NA, Polansky MM, and Anderson RA.(1990). Insulin potentiating factor and chromium content of selected foods and spices. Bio. Trace. Element Res. 24: 183-188.

Khan A, Safdar M, Ali-Khan MM, Khattak KN, and Anderson RA.(2003). Cinnamon improves glucose and lipids of peoples with type 2 diabetes. Diabetes Care . 26: 3215-3218.

Lopez P, Sanchez C, Batlle R, and Nerin C.(2005). Solid- and varpour- phase antimicrobial activities of six essential oils: susceptibility of selected foodborne bacterial and fungal strains. J. Agric Food Chem. 53: 6939-6946.

Mang B, Wolters M, and Schmitt B, (2006). Effects of a cinnamon extract on plasma glucose, HbA1c, and serum lipids in diabetes mellitus type 2. Eur J Clin Invest. 36:340–344.

Mokdad AH. (2007)Health issues in the Arab American community. Chronic diseases and the potential for prevention in the Arab world: the Jordanian experience. Ethn Dis;17(2 Suppl 3):S3-55-56.

Solomon TPJ, and Blannin AK. (2007).Effects of short-term cinnamon ingestion on in vivo glucose tolerance. Diabetes Obes Metab. 9(6): 895-901.

Vanschoonbeek K, Thomassen BJ, Senden JM, Wodzig WK, van and Loon LJ. (2006). Cinnamon supplementation does not improve glycemic control in postmenopausal type 2 diabetes patients. J Nutr. 136(4): 977–80.

Ziegenfuss TN, Hofheins JE, Mendel RW, Landis J, and Anderson RA. (2006). Effects of a Water-Soluble Cinnamon Extract on Body Composition and Features of the Metabolic Syndrome in Pre-Diabetic Men and Women. J Int Soc Sports Nutr. 3(2): 45–53.

Zindah M, Belbeisi A, Walke H, Mokdad AH.(2004). Obesity and diabetes in Jordan: findings from the Behavioral Risk Factor Surveillance System, Prev Chronic Dis 2008;5(1).