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Cinnamon May Reduce Glucose, Lipid and Cholesterol Level in Type 2 Diabetic Individuals

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Abstract: The effect of cinnamon on blood glucose and lipid profile was studied in type-2 diabetic individuals for 30 days. Fourteen diabetic individuals of both sexes and of age 40 and above were divided in two groups, each having 7 individuals. Group 1 was assigned for 1.5 g cinnamon dose/day while group 2 was assigned for 1.5g placebo dose/day. The doses were given for 30 days. Fasting blood samples were collected at the start of experiment (day 0) and at the end of experiment (day 30). Serum glucose, serum triglycerides, serum total cholesterol, high density lipoprotein HDL and low density lipoprotein LDL cholesterol, of both cinnamon and placebo groups were determined. The results showed that cinnamon dose significantly reduced glucose, triglycerides and cholesterol. HDL and LDL cholesterol were not affected. Placebo did not affect any of the above parameters.

Key words: Cinnamon, blood glucose, lipid profile, type-2 diabetes

INTRODUCTION

Diabetes mellitus is a disorder of glucose metabolism, characterized by high blood sugar level that results from the body's inability to make or use insulin. Diabetes can lead to life threatening complications including blindness, memory problems, kidney diseases, heart disease, nerve damage and amputation (Robinson *et al*., 1986). The most common type is type 2 diabetes, which usually develops because of the body's inability to use insulin properly. It commonly occurs in people of age 40 and above and who are obese (Khan and Ahmad, 1994). Dietary therapy should be the primary approach for the treatment of diabetes. This approach is natural, economical and feasible in developing countries. The broad aims of dietary prescription for people with diabetes remain, first, to abolish the primary symptoms, secondly to minimize the long term macro vascular and micro vascular complications which together results in morbidity and shortened life span with all types of diabetes (Camerini-Davalos and Cole, 1987).

The diabetic diet should contain 60% carbohydrate, 20-25% fat and 15-20% protein. High carbohydrate diet increases the sensitivity of peripheral tissue to both endogenous and exogenous insulin. Such diet improves glucose intolerance and lowers levels of serum insulin (Khan and Ahmad, 1994).

Recently some of the spices like cinnamon, cloves, bay leaves and turmeric have been reported to have insulin potentiating factor which potentiates the function of insulin in glucose metabolism (Khan *et al*., 1990). This study was initiated to confirm the previous findings that cinnamon intake reduces glucose, triglycerides and cholesterol in type 2 diabetic individuals.

MATERIALS AND METHODS

The study was conducted in the Institute of Biotechnology and Genetic Engineering (IBGE), Agricultural University Peshawar, North West Frontier Province, Pakistan. This study was approved by the Ethics Committee and Board of Studies of the University. The criterion for selection was that the type 2 diabetic patients should be of both sexes and of age 40 and above. The blood sugar of these patients must be 125 mg/dl or above and these patients should not be on insulin therapy. Diabetic patients in Abasine Institute of Medical Sciences (AIMS) were screened and 14 type 2 diabetic patients were selected and registered for the study. The registered patients were randomly divided into two groups, each of seven individuals. One group was assigned for 1.5 g cinnamon/day while the other was assigned for 1.5 g placebo dose/day.

The required amount of cinnamon and maize flour (placebo) was purchased from the local market and was ground finely and put in to capsules. Each capsule was containing 0.5 g cinnamon or maize flour. The study was conducted for 30 days. A dose of 1.5 g cinnamon/day and 1.5 g placebo/day in the form of capsules were given for 30 days to the individuals of group1 and group2 respectively. Dose of cinnamon and placebo were spread over the day as breakfast, lunch and dinner. For example 1.5 g dose of cinnamon per day was spread

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over the day as 0.5 g (one capsule) of cinnamon after breakfast, 0.5 g (one capsule) of cinnamon after lunch and 0.5 g (one capsule) after dinner. The placebo dose was spread over the day in the same pattern.

Approximately 5ml fasting blood samples were taken from each individual on day 0 before the experimental trial was started (control) and on day 30, when the experimental trial was completed. Blood samples were transferred to sterilized centrifuge tubes and allowed for clotting at room temperature. The blood samples were centrifuged for 5 min in a centrifuge at 4,000 rpm for serum separation. Separated serums were transferred to eppindorf tubes and were freezed for later analysis.

Glucose was determined by the enzymatic colorimetric method of Tinder and Ann (1969). Triglyceride was determined by enzymatic calorimetric procedure of Werner *et al*. (1981). Cholesterol was determined by the enzymatic colorimetric method of Allian *et al*. (1974). LDL (Low Density Lipoproteins) was precipitated by adding phosphotungstic acid and magnesium ion to the sample. Centrifugation left only the HDL (High Density Lipoproteins) in the supernatant; their cholesterol content was determined by the method of Assmann (1979). Auto analyzer (Express plus, Ciba corning, USA) and Elitech kits were used.

Statistical analysis: Two- way Analysis of Variance and Randomized Complete Block Design (RCBD) was used for statistical analysis (MSTAT-C with MGRAPH, Russell D. Freed, MSTAT, Crop and Soil Sciences Department, Michigan State University, Version 2.00).

RESULTS AND DISCUSSION

Effect of cinnamon and placebo on serum glucose: The effect of cinnamon and placebo on serum glucose in type 2 diabetic individuals is given in Table 1. The mean glucose values on day 0 in Table 1 indicate the fasting serum glucose of diabetic individuals before the start of intake of cinnamon and placebo capsules and were considered as control values for the study.

On the starting day of the experiment (day 0), the mean fasting serum glucose concentration of the diabetic individual of group 1, assigned for 1.5 g cinnamon dose/day was 216.3±52.7 mg/dl. When Diabetic individuals of this group used the above dose of cinnamon for 30 days, their mean fasting serum glucose level was reduced to 163.3±44.9 mg/dl. This reduction in glucose was significant at $p<0.05$. To verify that the drop in the fasting blood glucose was not due to psychological effect of the cinnamon capsules, placebo capsules were given to group 2 in the same pattern as the cinnamon. After 30 days blood samples were collected and analyzed which showed that placebo dose did not affect the glucose level.

Effect of cinnamon and placebo on triglycerides: The effect of cinnamon and placebo on triglycerides in type 2 diabetic individuals is given in Table 2. The triglycerides values on day 0 in Table 2 indicate the fasting serum triglycerides of diabetic individuals before the start of intake of cinnamon and placebo capsules and were considered as control values for the study.

On the starting day of the experiment (day 0), the mean fasting serum triglycerides of the diabetic individual of group 1, assigned for 1.5 g cinnamon dose/day was 186.1±124.2 mg/dl. When the diabetic individuals of this group used 1.5 g cinnamon dose/day for 30 days, their mean fasting serum triglycerides level significantly reduced to 142.6±36.7 mg/dl at $p<0.05$. To verify that the drop in the fasting serum triglycerides was not due to psychological effect of the cinnamon capsules, placebo capsules were given to group 2 in the same pattern as

Table 1: Effect of cinnamon and placebo on serum glucose in type 2 diabetic individuals

		Fasting serum glucose[1,2] mg/dl	
		Before intake of cinnamon/placebo	After intake of cinnamon/placebo
Group of diabetes	Dose of cinnamon/ placebo (1.5 g/day)	Day 0	Day 30
1	Cinnamon	216.3^{A}±52.7	163.3^{B}±44.9
2	Placebo	204.1^{A}±44.7	232.00^{A}±65.0

1. Values given in column 3 and 4 of the respective rows are the means and standard deviations of 7 individuals.
2. Means followed by different letters in the rows are significantly different at $p<0.05$ as determined by analysis of variance

Table 2: Effect of cinnamon and placebo on serum triglycerides in type 2 diabetic individuals

		Fasting serum TGL[1,2] mg/dl	
		Before intake of cinnamon/placebo	After intake of cinnamon/placebo
Group of diabetes	Dose of cinnamon/ placebo (1.5 g/day)	Day 0	Day 30
1	Cinnamon	186.1^{A}± 24.2	142.6^{B}±36.7
2	Placebo	221.9^{A}±124.2	223.00^{A}±103.1

1. Values given in column 3 and 4 of the respective rows are the means and standard deviations of 7 individuals.
2. Means followed by different letters in the rows are significantly different at $p<0.05$ as determined by analysis of variance

the cinnamon. After 30 days blood samples were collected and analyzed which showed that placebo dose have no effect on the serum triglycerides in diabetic individual.

Effect of cinnamon and placebo on serum cholesterol: Effect of cinnamon and placebo on serum cholesterol in Type 2 diabetic individuals is shown in Table 3. The cholesterol values on day 0 in Table 3 indicate the fasting serum cholesterol concentration of diabetic individuals before the start of intake of cinnamon and placebo capsules and were considered as control values for the study.

On the starting day of the experiment (day 0), the mean fasting serum cholesterol concentration of the diabetic individual of group 1, assigned for 1.5 g cinnamon dose/day was 182.4±40.7 mg/dl. When the diabetic individuals of this group used 1.5 g cinnamon dose/day for 30 days, their mean fasting cholesterol concentration dropped significantly ($p<0.05$) to 151.4±29.2 mg/dl. To know that this drop in the fasting blood cholesterol was not due to psychological effect of the cinnamon capsules, placebo capsules were given to group 2 in the same pattern as the cinnamon. The placebo dose did not affect the cholesterol concentration in the diabetic individuals.

Effect of cinnamon and placebo on serum HDL-cholesterol: The effect of cinnamon and placebo on serum HDL-cholesterol in type 2 diabetic individuals is given in Table 4. The HDL values on day 0 in Table 4 indicate the fasting serum HDL of diabetic individuals before the start of intake of cinnamon and placebo capsules and were considered as control values for the study.

On the starting day of the experiment (day 0), the mean fasting serum HDL cholesterol concentration of the diabetic individual of group 1, assigned for 1.5 g cinnamon dose/day was 35.3±3.5 mg/dl. When diabetic individuals of this group used 1.5 g cinnamon dose/day for 30 days, their mean fasting serum HDL cholesterol concentration dropped non significantly to 34.7±3.2 mg/dl. Placebo did not affect HDL-cholesterol in type 2 diabetic individuals.

Effect of cinnamon and placebo on serum LDL-cholesterol: The effect of cinnamon and placebo on serum LDL-cholesterol in type 2 diabetic individuals is given in Table 5. The serum LDL cholesterol values on day 0 in Table 5 indicate the fasting serum LDL values of diabetic individuals before the start of intake of cinnamon and placebo capsules and were considered as control values for the study.

Table 3: Effect of cinnamon and placebo on serum cholesterol in type 2 diabetic individuals

		Fasting serum cholesterol[1,2] mg/dl	
		Before intake of cinnamon/placebo	After intake of cinnamon/placebo
Group of diabetes	Dose of cinnamon/ placebo (1.5 g/day)	Day 0	Day 30
1	Cinnamon	182.4^{A}±40.7	151.4^{B}±29.2
2	Placebo	184.4^{A}±29.6	180.1^{A}±13.2

1. Values given in column 3 and 4 of the respective rows are the means and standard deviations of 7 individuals.
2. Means followed by different letters in the rows are significantly different at $p<0.05$ as determined by analysis of variance

Table 4: Effect of cinnamon and placebo on serum HDL-cholesterol in type 2 diabetic individuals

		Fasting serum HDL[1,2] mg/dl	
		Before intake of cinnamon/placebo	After intake of cinnamon/placebo
Group of diabetes	Dose of cinnamon/ placebo (1.5 g/day)	Day 0	Day 30
1	Cinnamon	35.3^{A}±3.5	34.7^{A}±3.2
2	Placebo	36.1^{A}±3.0	37.6^{A}±2.4

1. Values given in column 3 and 4 of the respective rows are the means and standard deviations of 7 individuals.
2. Means followed by different letters in the rows are significantly different at $p<0.05$ as determined by analysis of variance

Table 5: Effect of cinnamon and placebo on serum LDL-cholesterol in type 2 diabetic individuals

		Fasting serum LDL[1,2] mg/dl	
		Before intake of cinnamon/placebo	After intake of cinnamon/placebo
Group of diabetes	Dose of cinnamon/ placebo (1.5 g/day)	Day 0	Day 30
1	Cinnamon	109.7^{A}±38.1	88.6^{A}±25.1
2	Placebo	100.1^{A}±18.7	99.4^{A}±19.1

1. Values given in column 3 and 4 of the respective rows are the means and standard deviations of 7 individuals.
2. Means followed by different letters in the rows are significantly different at $p<0.05$ as determined by analysis of variance

On the starting day of the experiment (day 0), the mean fasting serum LDL cholesterol concentration of the diabetic individual of group 1, assigned for 1.5 g cinnamon dose/day was 109.7±38.1 mg/dl. When the diabetic individuals of this group used 1.5 g cinnamon dose/day for 30 days, their mean fasting serum LDL cholesterol concentration dropped non-significantly to 88.6±25.1 mg/dl. Placebo did not affect LDL-cholesterol in type 2 diabetic individuals.

Khan and Anderson (2003) studied the effect of cinnamon doses on blood glucose and lipid profile in type 2 diabetic individuals. They reported that the intake of 1, 3, or 6g of cinnamon per day reduced fasting serum glucose (18-29%), triglycerides (23-30%), LDL-cholesterol (7-27%) and total cholesterol (12-26%). In their study they gave the 3 doses of cinnamon for 30 days. They did not report any adverse effect of cinnamon on humans in their 30 days trial. Also people have been using cinnamon in food preparations for centuries, indicating that consumption of cinnamon in reasonable amounts is safe. Our study confirms their findings.

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