Original Article

Cinnamon on the Functions of Liver and Kidney in Type 2 Diabetic Individuals

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Objective: The objectives of this study were to know the effect of cinnamon on liver functions tests i.e. alanine transferase, alkaline phosphatase, bilirubin and on the renal function tests i.e. urea and creatinine in type 2 diabetic individuals.

Place and Duration: The study was conducted during the year 2007-2009 in the Institute of Biotechnology and Genetic Engineering, NWFP, Agricultural University Peshawar and Diabetic Hospital of Abbasin Institute of Medical Sciences, Peshawar, Pakistan.

Study Design:Randomized Complete Block Design (RCBD) was implemented, and two-way analysis of variance was used for statistical analysis.

Materials and Methods: Fourteen diabetic individuals of both sexes and of age 40 years and above were divided into two groups, each having 7 individuals. Group 1 was assigned for 1.5g cinnamon dose/day while group 2 was assigned for 1.5g placebo dose/day. Fasting blood samples were collected before starting the experiment (day 0) and at the end of the experiment (day 30) from both the cinnamon and placebo groups. Serum was separated and liver function tests namely, alanine amino transferase (ALT), alkaline phosphates (ALP), and bilirubin and renal function tests namely urea and creatinine of both groups 1 and 2 were determined by standard kit methods.

Results: ALT, ALP and Bilirubin concentration of type 2 diabetic individuals of the cinnamon and placebo groups were not changed and the values were in the normal range. Similarly urea and creatinine concentration of the type 2 diabetic individuals of the cinnamon and placebo groups were not changed and the values were in the normal range. The results indicated that cinnamon dose is not affecting the functions of liver and kidney.

Conclusion: Cinnamon intake may not affect the liver and renal functions in type 2 diabetic individuals and its intake may be safe and the diabetic individuals may use it for longer time for their sugar control

Keywords: Cinnamon, Liver functions, Renal functions

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Introduction

Cinnamon (Cinnamomum Cassia), has been generally used as spice for flavor and taste development in food preparation. After recent scientific findings, cinnamon has become popular as herbal treatment for type 2 diabetes. Khan et al[1] studied the effect of cinnamon on 60 type 2 diabetic individuals. They gave cinnamon orally for 40 days at three different doses (1, 3 and 6 g/day). After 40 days significant reduction in fasting blood sugar, cholesterol (including LDL or "bad" cholesterol) and triglycerides were noted at each dose. Another study demonstrated cinnamon extract was more effective than the cinnamon bark in reduction of blood glucose.[2] Mang et al. in 2006 evaluated a water soluble extract, corresponding to 3 grams of cinnamon, in 79 German participants with type 2 diabetes for four months. Although fasting glucose was lowered at the end of the trail but changes in cholesterol and triglycerides were not significant.[3]

Based on experimental trials and usage of cinnamon in food preparations for centuries, it can fairly be urged that consumption of cinnamon in reasonable amount is safe and type2 diabetes can take 1-2gm of cinnamon per day on regular basis for the control of their sugar level. However the question need to be answered is "whether regular intake of cinnamon would be safe at cellular level or not". Therefore this study was designed to determine the effect of cinnamon on liver functions namely alanine amino transferase (ALT), alkaline phosphates (ALP) and bilirubin and renal functions namely urea and creatinine.

Materials and Methods

The study was conducted in the department of biotechnology and genetic engineering, agricultural university, Peshawar and diabetic hospital of abbasin institute of medical sciences, Peshawar from September 2007 to March 2009. The study was approved by the ethics committee and board of studies of the department. The criteria for selection (of what) was type 2 diabetic patients should be of both sexes and of age 40 and above. The blood sugar (Fasting or Random) of these patients must be 125 mg/dl or above and these patients should not be on insulin therapy. Availability of diabetic patients fit on the above selection criteria was difficult and took almost one and half year to complete the study. Diabetic patients were screened and 14 type 2 diabetic patients were selected and registered for the study. The patients were randomly divided into two groups, each group consisting of seven individuals. One group was given 1.5g cinnamon/day and the other was given 1.5g placebo/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 0.5g cinnamon or maize flour. A dose of 1.5g cinnamon/day and 1.5g placebo/day in the form of capsules were given for 30 days to the individuals of group1 and group2 respectively. Dose of cinnamon was spread over the day as breakfast (0.5g), lunch (0.5g), and dinner (0.5g). 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, 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 minutes in a centrifuge at 4,000 rpm for serum separation. Separated serums were transferred to eppindorf tubes and were stored in freezer at -20°C for analysis later.

ALT was determined by Rosch kit withoutpyridoxal phosphate activation based on the procedure of Bregmeryeret al.[5] ALP was determined by standardized method recommended by International Federation of Clinical Chemistry (IFCC) in 1983. Bilirubin was determined by method developed by Wahlefeldet al.[6] In 1965, Talke and Schubert published a totally enzymatic procedure for the determination of urea using the coupled urease / glutamate dehydrogenase (GLDH) enzyme system.[7] The Roche UREA assay based on Talke and Schubert's method was used for the determination of urea. A creatinine concentration in urine was determined by the method based on the Jaffe reaction modified by Bartels.[8] Roche/ Hitachi 902 automated analyzer was 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

Results of the study are tabulated from table I-V. ALT, ALP and Bilirubin concentration of type 2 diabetic individuals of the cinnamon and placebo groups were not changed and the values were in the normal range. Similarly urea and creatinine concentration of the type 2 diabetic individuals of the cinnamon and placebo groups were not changed and the values were in the normal range. The results indicated that cinnamon dose is not affecting the functions of liver and kidney.

Table I: Effect of Cinnamon and Placebo on ALT in Type 2 Diabetic Individuals.

Group of Diabetes	Dose of Cinnamon/ Placebo (1.5g/day)	Fasting Serum ALT[1,2] U/L	
		Before intake of Cinnamon/ Placebo	After intake of Cinnamon/Placebo
		Day 0	Day 30
1	Cinnamon	17.14 [A] ± 2.54	19.57 [A] ± 4.89
2	Placebo	14.57 [A] ± 3.15	17.14 [A] ± 4.98

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 II: Effect of Cinnamon and Placebo on ALP in Type 2 Diabetic Individuals.

Group of Diabetes	Dose of Cinnamon / Placebo (1.5g/day)	Fasting Serum ALP[1,2] U/L	
		Before intake of Cinnamon/ Placebo	After intake of Cinnamon/ Placebo
		Day 0	Day 30
1	Cinnamon	93.17[A] ± 17.37	92.14 [A] ± 20.73
2	Placebo	85.42 [A] ± 13.39	85.42 [A] ± 13.39

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 III: Effect of Cinnamon and Placebo on Serum Bilirubin in Type 2 Diabetic Individuals.

Group of Diabetes	Dose of Cinnamon/Placebo (1.5g/day)	Fasting Serum Bilirubin[1,2] mg/dl	
		Before intake of Cinnamon/ Placebo	After intake of Cinnamon/Placebo
		Day 0	Day 30
1	Cinnamon	0.57[A] ± 0.16	0.60[A] ± 0.16
2	Placebo	0.64[A] ± 0.11	0.65[A] ± 0.10

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 IV: Effect of Cinnamon and Placebo on Urea in Type 2 Diabetic Individuals.

Group of Diabetes	Dose of Cinnamon/ Placebo (1.5g/day)	Fasting Serum Urea[1,2] md/dl	
		Before intake of Cinnamon/Placebo	After intake of Cinnamon/Placebo
		Day 0	Day 30
1	Cinnamon	27.14[A] ± 5.18	26.28[A] ± 6.24
2	Placebo	23.57[A] ± 6.80	27.57[A] ± 6.85

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 V: Effect of Cinnamon and Placebo on Creatinine in Type 2 Diabetic Individuals.

Group of Diabetes	Dose of Cinnamon/ Placebo (1.5g/day)	Fasting Serum Creatinine[1,2] mg/dl	
		Before intake of Cinnamon/Placebo	After intake of Cinnamon/Placebo
		Day 0	Day 30
1	Cinnamon	0.68[A] ± 0.11	0.64[A] ± 0.14
2	Placebo	0.66[A] ±0.17	0.66[A] ± 0.13

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.

Discussion

Effect of Cinnamon on ALT: ALT is the most frequently utilized and specific test for hepatocellular necrosis and its level is increased in almost all liver diseases.[9] Declining of ALT may indicate either recovery or poor prognosis in hepatic failure.[10]

The effect of cinnamon and placebo on ALT in type 2 diabetic individuals is given in Table 1. The ALT values on day 0 in Table 1 are the serum ALT of type 2 diabetic individuals before the start of cinnamon and placebo capsules and were considered as the control values for the study.

On the starting day of the experiment (day 0), the mean value of ALT of group 1, assigned for 1.5g cinnamon dose/day was 17.14 ± 2.54 U/L. When this group used cinnamon dose for 30 days, their mean ALT level was 19.57 ± 4.89 U/L. There was no significant difference between the values at day 0 and at day 30 at p<0.05. Also the values of ALT at day 0 and at day 30 were in the normal range. The normal range of ALT is 10-55 U/L .[11] The value of ALT in the placebo trial was 14.57 ± 3.15 on day 0 and17.14 ± 4.98 on day 30. Again there was no significant difference at p < 0.05 and the values were in the normal range. The data indicated that intake of cinnamon dose for 30 days did not affect the ALT level in Type2 diabetes which means that intake of cinnamon for diabetes is safe as far as ALT is concerned.

Effect of Cinnamon on ALP: ALP levels are higher in primary biliary cirrhosis, alcoholic hepatitis, gallstone in choledocholithiasis.[12] Both intrehepatic and extra hepatic obstruction to the bile flow results in elevated ALP values.[13]

The effect of cinnamon and placebo on ALP in type 2 diabetic individuals is given in Table 2. The ALP values on day 0 in Table 2 indicates the serum ALP before the start of cinnamon and placebo capsules and were considered the control values for the study.

On the starting day of the experiment (day 0), the mean value of ALP of group 1, assigned for 1.5g cinnamon dose/day was 93.17 ± 17.37 U/L. When this group used cinnamon dose for 30 days, their mean ALP level was 92.14 ± 20.73 U/L. There was no significant difference between the values of ALP at day 0 and at day 30 at p<0.05. Also the values of ALP at day 0 and at day 30 were in the normal range. The normal range of ALP is 45-115 U/L.[11] The value of ALP in the placebo trial was 85.42 ± 13.39 on day 0 and 85.42 ± 13.39 on day 30.

Again there was no significant difference at $p < 0.05$ and the values were in the normal range. The data indicated that intake of cinnamon dose for 30 days did not affect the ALP level in Type2 diabetes which means that intake of cinnamon for diabetes is safe as indicated by no increase in ALP level.

Effect of Cinnamon on Serum Bilirubin: Bilirubin is a major breakdown product of hemoglobin. Increased bilirubin production results from impaired hepatic excretion or regulation of conjugated and unconjugated bilirubin from the hepatocytes.

The effect of cinnamon and placebo on ALP in type 2 diabetic individuals is given in Table 3. The serum bilirubin values on day 0 in Table 3 indicates the serum bilirubin before the start of cinnamon and placebo capsules and were considered the control values for the study.

On the starting day of the experiment (day 0), the mean value of serum bilirubin of group 1, assigned for 1.5g cinnamon dose/day was 0.57 ± 0.16 mg/dL. When this group used cinnamon dose for 30 days, their mean serum bilirubin level was 0.60 ± 0.16 mg/dL. There was no significant difference between the values of serum bilirubin at day 0 and at day 30 at $p<0.05$. Also the values of serum bilirubin at day 0 and at day 30 were in the normal range. The normal range of serum bilirubin is 0-1mg/dL.[11] The value of serum bilirubin in the placebo trial was 0.64 ± 0.11 on day 0 and 0.65 ± 0.10 on day 30. Again there was no significant difference at $p < 0.05$ and the values were in the normal range. The data indicated that intake of cinnamon dose for 30 days did not affect the serum bilirubin level in Type2 diabetes which means that intake of cinnamon for diabetes is safe.

Effect of Cinnamon on Urea: High urea level can indicate kidney dysfunction but as it values varies with protein intake, liver metabolic capacity and renal perfusion so it is a poor guide to renal function. However with creatinine test, it shows the ability of kidney to filter waste products from the blood and excrete them to urine.[17]

The effect of cinnamon and placebo on serum urea in type 2 diabetic individuals is given in Table 4. The serum urea values on day 0 in Table 4 indicates the serum urea before the start of cinnamon and placebo capsules and were considered the control values for the study.

On the starting day of the experiment (day 0), the mean value of serum urea of group 1, assigned for 1.5g cinnamon dose/day was 27.14 ± 5.18 mg/dL. When this group used cinnamon dose for 30 days, their mean serum urea level was 26.28 ± 6.24 mg/dL. There was no significant difference between the values of urea at day 0 and at day 30 at $p<0.05$. Also the values of urea at day 0 and at day 30 were in the normal range. The normal range of serum urea is 8-20mg/dL.[18] The value of serum urea in the placebo trial was 23.57 ± 6.80 on day 0 and 27.57 ± 6.85 on day 30. Again there was no significant difference at $p < 0.05$ and the values were in the normal range. The data indicated that intake of cinnamon dose for 30 days did not affect the serum urea level in Type2 diabetes which means that intake of cinnamon for diabetes is safe.

Effect of Cinnamon on Creatinine

Serum creatinine is the most reliable guide as it is produced from the muscle at constant rate and almost completely filtered at the glomerulus. High serum creatinie levels are observed in Type2 diabetes due to renal impairment.[19]

The effect of cinnamon and placebo on serum creatinine in type 2 diabetic individuals is given in Table 5. The serum creatinine values on day 0 in Table 5 indicates the serum creatinine before the start of cinnamon and placebo capsules and were considered the control values for the study.

On the starting day of the experiment (day 0), the mean value of serum creatinine of group 1, assigned for 1.5g cinnamon dose/day was 0.68 ± 0.11 mg/dL. When this group used cinnamon dose for 30 days, their mean serum creatinine level was 0.64 ± 0.14 mg/dL. There was no significant difference between the values of creatinine at day 0 and at day 30 at $p<0.05$. Also the values of serum creatinine at day 0 and at day 30 were in the normal range. The normal range of serum creatinine is 0.8- 1.2mg/dL.[19] The value of serum creatinine in the placebo trial was 0.66 ± 0.17 on day 0 and 0.66 ± 0.13 on day 30. Again there was no significant difference at $p < 0.05$ and the values were in the normal range. The data indicated that intake of cinnamon dose for 30 days did not affect the serum creatinine level in Type2 diabetes and diabetic individuals can take cinnamon for their sugar control.

Our data on LFT and RFT demonstrated that cinnamon dose did not change the concentration of ALT, ALP, bilirubin, urea and creatinine in diabetic individuals indicating that intake of cinnamon is not affecting the function of liver and kidney. Khan et al., (2003) 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.[20] In the light of this study usage of cinnamon by diabetes for their sugar control is safe and diabetic individuals can take cinnamon for their sugar control,

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Conclusion

Cinnamon intake may not affecting the liver and renal functions in type 2 diabetic individuals and its intake may be safe and the diabetic individuals may use it for longer time for their sugar control

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