

# Anti-diabetic Effects of Cinnamon Extract in Alloxan-Induced Diabetic Rats in Comparison with Oral Hypoglycemic Drugs

Muhammad Sajid Khan<sup>\*</sup>, Ahmad Azmi<sup>\*\*</sup>, Syed Hyder Raza Naqvi<sup>\*\*\*</sup>, Tabinda Taqi<sup>\*</sup>

## ABSTRACT

**Objectives:** To observe the anti-diabetic efficacy of herbal plant in diabetes mellitus in comparison with conventional oral hypoglycemic drugs in animal model.

**Study Design:** Experimental, Comparative.

**Place and duration:** Department of Physiology, AL-Tibri Medical College & Hospital, ISRA University Karachi Campus, from July 2013 to December 2013.

**Material and Methods:** Sixty albino rats divided into six groups each is further subdivided into two groups. Diabetes was induced by single dose of intraperitoneal injection of alloxan 150mg/kg body weight. Ethanol based cinnamon stem bark extract was prepared with working solution of acarbose and tolbutamide. After induction of diabetes when blood sugar level reaches to 250mg/dl the animal was used for further study. Blood sugar and serum insulin were measured to evaluate the antidiabetic effects of cinnamon bark extract. The data was collected and entered into data sheet of SPSS version 17. For analysis of data student T test and one way ANOVA was used.

**Results:** A significant reduction of blood glucose level was noted in cinnamon extracts treated groups with marked improvement in the serum insulin level. Tolbutamide and acarbose treated groups showed better antidiabetic effect as compare to cinnamon extract treated groups (p value=0.007 and 0.012), but cinnamon extract treated group showed synergetic effect when it was given in combination with tolbutamide and acarbose having significant p value=0.001 and 0.011 respectively.

**Conclusion:** Cinnamomum cassia extract has good synergetic effect when it is used with conventional anti diabetic therapy but alone its anti-diabetic efficacy is minimal in comparison with other oral hypoglycemic agents.

**Key words.** Cinnamon, Diabetes, Aalloxan, Tolbutamide, Acarbose.

- \* Assistant Professor, Dept. of Physiology, Al-Tibri Medical College, Karachi.
- \*\* Professor & Chairman, Dept. of Physiology, Al-Tibri Medical College, Karachi.
- \*\*\* Associate Professor, Dept. of Pharmacology, ISRA University, Hyderabad.

### Correspondence to:

**Dr. Muhamad Sajid Khan**

Assistant Professor,  
Dept. of Physiology,  
Al-Tibri Medical College,  
Karachi.  
Cell: 0300-9254901  
Email: dr.sajidkhan12@hotmail.com

## INTRODUCTION:

The genus cinnamon is a fragrant tree which belongs to the family of Lauraceae. The cinnamon bark contains essential oil. Chemically bark mostly contain Cinnamaldehyde 45-65%, eugenol 12-18%<sup>1</sup>, and cinnazeyline, cinnzelonol and benzoxycinnamaldehyde in small amount<sup>2</sup>. It has also been reported that cinnamon extract have many beneficial role in the body but the most important effect is on normal and impaired glucose tolerance, insulin sensitivity and insulin resistance<sup>3</sup>.

The aqueous extract of cinnamon has increase glucose uptake ability and glycogen

synthesis. It also increase phosphorylation of insulin receptor as well as insulin cascade system<sup>4,5</sup>. All these biochemical parameter are involved in improving diabetes status like all medicinal plants. Cinnamon also contain the most bioactive constituent which effect on carbohydrate metabolism<sup>6</sup>. It was found that cinnamon extract and its components mainly cinamaldehyde have beneficial effect on avoiding the metabolic syndrome<sup>7,8</sup>, as well as having remarkable pharmacological effect in treatment of type II diabetes.

Very little research work has been done to evaluate the comparative effect of ethanol based cinnamon extract with hypoglycemic drugs. Therefore, present study was carried out to evaluate the anti-diabetic effect of ethanol-based Cinnamon bark extract in allaxon- induced diabetic rats in comparison with two oral hypoglycemic drugs tolbutamide and acarbose. This study could be useful for the control of mildly elevated blood sugar level particularly in person with type 2 diabetes mellitus. Cinnamon is safe herbal drug as compared to oral hypoglycaemic drugs.

## MATERIAL & METHODS:

This was animal based experimental study carried out in the Deptt. of Physiology and Animal House of Al Tibri Medical College Isra University Karachi campus, from July 2013 to December 2013.

Sixty albino rats with body weight of 150-200gm were involved in the study, except control group all the rats having blood glucose level = 250mg/dl.

Sixty albino rats were divided into six group and each group is further subdivided into two group. Division Of Groups:

### Group A (n = 10)

- Group A1- Simple control (n = 5)  
Treated with normal saline only
- Group A2- Diabetic Control (n = 5)  
Treated with Alloxan only

### Group B (n = 10)

- Group B1 (n = 5)  
Treated with low dose cinnamon extract (200 mg / kg body weight)
- Group B2 (n = 5)  
Treated with high dose cinnamon extract (600 mg / kg body weight)

### Group C (n = 10)

- Group C1 (n = 5)  
Low dose of tolbutamide (15 mg / kg body weight)
- Group C2 (n = 5)  
High dose of tobutamide (30 mg / kg body weight)

### Group D (n = 10)

- Group D1 (n = 5)  
Low dose of acarbose (30 mg / kg body weight)
- Group D2 (n = 5)  
High dose of acarbose (60 mg / kg body weight)

### Group E (n = 10)

- E1 (n = 5) = L Ext + L Drug 1 (Tolbutanide)
- E2 (n = 5) = L Ext + L Drug 2 (Acarbose)

### Group F (n = 10)

- F1 (n = 5) = H Ext + H Drug 1 (Tolbutamide)
- F2 (n = 5) = H Ext + H Drug 2 (Acarbose)

Diabetes was induced by single dose of intraperitoneal injection of alloxan 150mg/kg body weight. Ethanol based cinnamon stem bark extract was prepared .working solution of acarbose and tolbutamide were also prepared. The data was collected and entered into data sheet of SPSS version 17. For analysis of data student T test and one way ANOVA was used.

**RESULTS**

**Table-1: Mean Blood Sugar Level (mg/dl)**

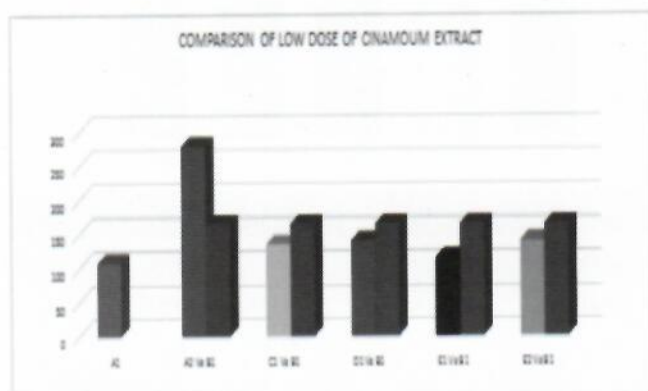
Group	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2
Blood Sugar mg/dl (mean)	90	280	160	165	140	135	150	140	130	140	120	134

A1 = Control  
 B1 = Low dose cinnamon extract  
 C1 = Low dose Tolbutamide  
 D1 = Low dose Acarbose  
 E1 = Low dose Extract + Low dose Tolbutamide  
 F1 = High dose Extract + High dose Tolbutamide

A2 = Negative Control (-ve)  
 B2 = High dose cinnamo extract  
 C2 = High dose Tolbutamide  
 D2 = High dose Acarbose  
 E2 = Low dose Extract + Low dose Acarbose  
 F2 = High dose Extract + High dose Acarbose

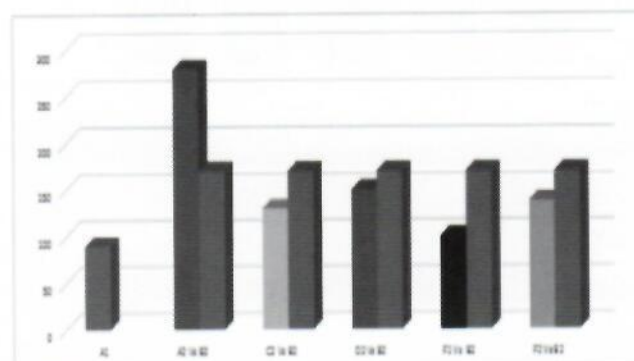
Table-1 shows the mean blood glucose level (mg/dl) has been compared between the different groups of animals at low dose and high doses.

0.007 and 0.012 respectively), but cinnamon extract treated groups showed synergetic effect when it was given in combination with tolbutamide and acarbose having significant p value = 0.001 and 0.011 respectively.



GROUPS	P value	SD
C1 VS B1	0.007	6.292
D1 VS B1	0.012	6.455
E1 VS B1	0.001	6.291
E2 VS B1	0.011	8.539

**Fig 1: Blood Glucose Level (mg/dl) Comparison between groups (Low dose)**



GROUPS	P value	SD
C2 VS B2	0.002	6.292
D2 VS B2	0.023	11.087
F1 VS B2	0.001	9.129
F2 VS B2	0.018	18.679

**Fig 2: Blood Glucose Level (mg/dl) Comparison between Group (High dose)**

In fig 1 the animal of group B1 when compared with other groups, there is a reduction in blood glucose level in alloxan induced diabetic rats with low dose (200mg/kg.bw) of cinnamon extract. Also tolbutamide and acarbose treated groups showed better antidiabetic effects as compared with cinnamon extract treated groups (p-value =

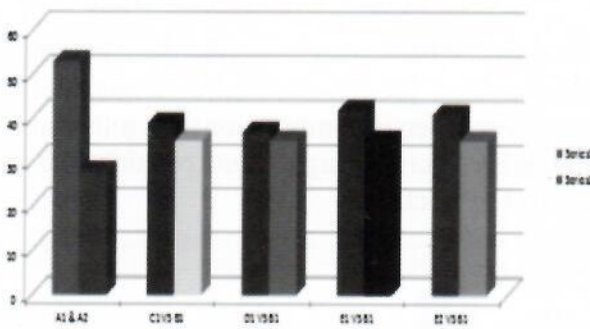
The combination of high dose of cinnamon extract i.e. (600mg/kg.bw) with high doses of tolbutamide and acarbose having excellent synergetic effect (p value 0.001 and 0.018) on decreasing serum blood glucose level respectively in comparison alone. (fig 2)

**Table-2: Mean Blood Insulin Level (U/ml)**

Group	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2
Blood Insulin U/ml (mean)	53.83	28.16	38.50	37.33	40.16	41.66	48.00	40.50	42.00	41.16	43.83	42.50

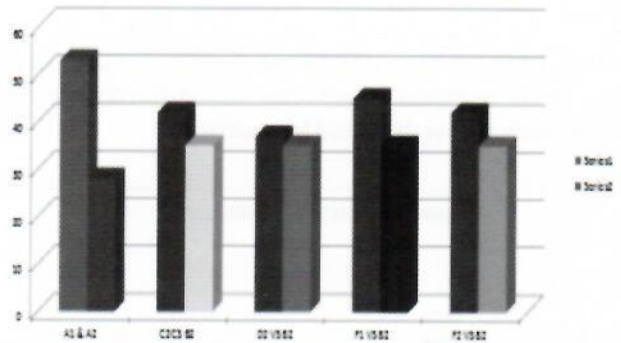
A1 = Control  
 B1 = Low dose cinnamon extract  
 C1 = Low dose Tolbutamide  
 D1 = Low dose Acarbose  
 E1 = Low dose Extract + Low dose Tolbutamide  
 F1 = High dose Extract + High dose Tolbutamide

A2 = Negative Control (-ve)  
 B2 = High dose cinnamon extract  
 C2 = High dose Tolbutamide  
 D2 = High dose Acarbose  
 E2 = Low dose Extract + Low dose Acarbose  
 F2 = High dose Extract + High dose Acarbose



GROUPS	P value	SD
C1 VS B1	0.011	1.500
D1 VS B1	0.016	0.816
E1 VS B1	0.004	1.708
E2 VS B1	0.014	2.222

**Fig 3: Serum Insulin Level (U/ml) Comparison between Groups (Low dose)**



GROUPS	P value	SD
C2 VS B2	0.001	0.957
D2 VS B2	0.035	0.958
F1 VS B2	0.001	1.414
F2 VS B2	0.009	2.062

**Fig 4: Serum Insulin Level (U/ml) Comparison between Groups (High dose)**

In fig 3, the comparative results of group B1 with rest of the groups on serum insulin level shows that the alloxan induced diabetic rats that were later on treated with low dose of cinnamon extract (200mg/kg.bw), there is an alarming increase in the level of serum insulin level. The groups that were treated with low dose of tolbutamide and acarbose confirms good anti-diabetic effect (p-value = 0.011 and 0.016 respectively). Furthermore, when low dose of extract was given in combination with low dose of tolbutamide and acarbose in their respective group, a significant synergetic effect (p value = 0.004 and 0.014) was observed with both drugs respectively.

Serum insulin level was observed high even after given high dose cinnamon extract i.e. (600mg/kg.bw) in alloxan treated diabetic rats. But the combination of cinnamon extract with tolbutamide and acarbose reflects a mark decrease in the serum insulin level that shows a better control on hyperglycemia with significant p value 0.001 and 0.009 probability. (fig 4)

**DISCUSSION:**

The present study was designed to observe the anti diabetic effect of ethanol based extract of Cinnamon bark in alloxan induced diabetic rats and compared it with oral hypoglycemic drugs i.e

tolbutamide and acarbose. Many herbs that have hypoglycemic characteristics are widely used as non prescription treatment for diabetes.

In this study diabetes was induced in rats by giving the injection of alloxan monohydrate intraperitoneally at the dose of 150mg/kg. body weight. The similar findings has been reported by other researchers<sup>9-11</sup>.

In present study two dose of cinnamon bark extract were given, low dose=200mg/kg.bw and high dose = 600mg/kg.bw.

In this study it was noticed that low dose of cinnamon cassia extract is more effective in reducing the blood sugar level in animals than high dose of cinnamon extract. These finding are in line with findings of others researcher who also reported in the reduction of blood glucose levels<sup>12,13</sup>. The present study has also evaluated the anti-diabetic effect of Cinnamon bark extract in alloxan- induced diabetic rats and compared it with the oral hypoglycemic drugs i.e., tolbutamide and acarbose. To induced diabetes in rats 150mg/kg.bw of alloxan monohydrate was injected intraperitoneally. Our study is also agreed with the studies of other researchers who also used alloxan monohydrate by giving a dose of 150 mg /kg.bw to induce diabetes in rats<sup>9,11</sup>. The data regarding blood glucose obtained by the present study showed that alloxan-induced diabetic rats produced significant increase in blood glucose level. This finding by the present study is almost in line with the studies of others<sup>14-18</sup>. Those also reported a significant increase in blood glucose level in alloxan induced diabetic rats. The present study also assessed the anti-diabetic effect of Cinnamon extract with low dose (200mg/kg bw) and high dose (600mg/kg bw) to diabetic rats. When cinnamon extract was administered to rats with low dose orally by feeding tube, significant reduction in blood glucose level was noticed. The hypoglycemic drugs such as tolbutamide and acarbose on the other hand showed better anti-diabetic effect as compared to cinnamon extract treated group (P-value=0.007 and 0.012) respectively, but cinnamon extract showed synergetic effect when it was given in combination with hypoglycemic drugs and giving

significant P-value = 0.001 and 0.0111 respectively. Similarly when high dose 600mg/kg .bw of cinnamon extract was given to diabetic rats a comparatively less effect was noticed. The same findings were also reported in other studies<sup>10,19,20</sup>.

It has also been claimed by many authors that the reduction in blood glucose level may be due to the active anti-hypoglycemic agents present in extract<sup>21</sup>. The mode of action of hypoglycemic activity of cinnamon extract may be due to the increase in serum insulin level occupancy of receptors and insulin-mimetic effects. In the present study low dose of cinnamon extract treated groups when compared with other groups of animals, there is an increase in serum insulin level in alloxan-induced diabetic rats when treated with low dose (200 mg/kg.bw.) of cinnamon extract. Hypoglycemic drugs treated group show better anti-diabetic effect in comparison with cinnamon extract treated group, P-value= 0.011 and 0.016 respectively. Synergetic effects were also seen in combination group having significant P-value=0.004 and 0.014 respectively. The same finding was also noted by Mahpara et al<sup>23</sup>. Also the animals of cinnamon extract treated groups when compared with other groups with high dose 600 mg/kg bw, there is an increase in serum insulin level. Hypoglycemic drugs treated groups showed better anti-diabetic effect as compared with cinnamon extract treated groups P-value=0.001 and 0.035 respectively but cinnamon extract treated group showed synergetic effect when it is given in combination with tolbutamide and acarbose having significant P-value=0.001 and 0.009 respectively. The present study also agreed with the study of Qin et al<sup>24</sup>. Therefore, the present study claimed that cinnamon extract has less anti-diabetic effect as compared with hypoglycemic drugs and may be used as medicine when given in combination with anti-diabetic agents.

#### CONCLUSION:

It is concluded that cinnamon cassia extract has less antidiabetic activity in comparison with oral hypoglycemic drugs alone and comparison but having synergetic effect when it is given in combination with oral antidiabetic agents

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