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## Effect of Cinnamon on Blood Glucose in Alloxan-Induced Diabetic Rats

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### ABSTRACT

*Diabetes mellitus is a long-lasting metabolic condition, which is marked by constant hyperglycemia caused by the failure of the insulin secretion or insulin action. There is interest in natural plant products as possible therapeutic agents against the management of diabetes. Cinnamon (*Cinnamomum verum*) is a traditionally used medicinal spice, which is said to have hypoglycemic effects. The given research was intended to assess the impact of cinnamon extract on blood glucose content of alloxan induced diabetic rats. Alloxan monohydrate induced diabetes in albino rats. The animals included four groups namely, normal control, diabetic control, cinnamon-treated diabetic group, and standard drug group. Cinnamon extract was taken orally in 21 days. Periodic pricing of blood glucose was done. The findings have shown that cinnamon significantly lowered the level of fasting blood glucose among diabetic rats, relative to untreated diabetic controls. Hypoglycemic effect can be explained by the existence of bioactive substances like polyphenols and methylhydroxy chalcone polymers which increase the insulin activity and glucose uptake. The research indicates that cinnamon has a great antidiabetic property and can be employed as a supportive medication to the management of diabetes.*

*Keywords: Cinnamon, Diabetes mellitus, Alloxan, Blood glucose, Albino rats, Herbal medicine.*

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### INTRODUCTION

Diabetes mellitus is among the commonly occurring metabolic diseases in the world and is described by the high levels of blood sugar in the blood as a result of either lack of insulin or resistance to insulin. Prolonged hyperglycemia causes the occurrence of complications involving different body organs, including kidney, liver, heart and nervous system. Chemical agents like alloxan are commonly used as experimental models to research on diabetes since alloxan specifically kills the pancreatic  $\beta$  cells and results in insulin deficiency and hyperglycemia [1].

Antidiabetic potential of natural plant products is being researched more and more because these are safe and readily available. Cinnamon (*Cinnamomum* spp.) is one of them; this spice has been widely used in medicine, and it has a number of medicinal values such as antioxidant, antimicrobial, and anti-inflammatory properties. Other studies have indicated that cinnamon has the potential of improving insulin sensitivity and lowering the level of blood glucose [2].

Hypoglycemic effect of cinnamon can be explained largely by bioactive substances like polyphenols, flavonoids and methylhydroxy chalcone polymers that increase the insulin receptor activity and increase the uptake of glucose by the cells.

Hence, the current research was aimed at assessing the impact of cinnamon extract on blood glucose of alloxan induced diabetic albino rats.

### MATERIAL AND METHODS

#### Experimental Animals

Healthy adult albino rats weighing 150–200 g were used for the study. Animals were maintained under standard laboratory conditions with controlled temperature, humidity, and a 12-hour light/dark cycle. They were fed with standard pellet diet and water ad libitum.

#### Preparation of Cinnamon Extract

Dried bark of cinnamon (*Cinnamomum verum*) was powdered and extracted using hydroalcoholic extraction methods. The extract was filtered and concentrated using a rotary evaporator and stored at 4°C until use.

### **Induction of Diabetes**

Diabetes was induced in overnight-fasted rats by intraperitoneal injection of alloxan monohydrate (120 mg/kg body weight) dissolved in normal saline. After 72 hours, rats with fasting blood glucose levels above 200 mg/dL were considered diabetic and included in the study.

### **Experimental Design**

The rats were divided into four groups (n = 6 each):

#### **Group Treatment**

Group I Normal control

Group II Diabetic control (alloxan only)

Group III Diabetic + Cinnamon extract (200 mg/kg body weight)

Group IV Diabetic + Standard drug (Glibenclamide 5 mg/kg)

Treatment was administered orally once daily for 21 days.

### **Determination of Blood Glucose**

Blood samples were collected from the tail vein after overnight fasting. Blood glucose levels were measured using a glucometer based on the glucose oxidase method.

### **Statistical Analysis**

Results were expressed as Mean  $\pm$  SEM. Statistical analysis was performed using one-way ANOVA followed by post-hoc tests. Differences were considered significant at  $p < 0.05$ .

## **RESULTS**

### **Effect of Cinnamon on Blood Glucose Levels in Alloxan-Induced Diabetic Rats**

Induction of diabetes using alloxan monohydrate resulted in a significant elevation of fasting blood glucose levels in experimental rats compared with the normal control group. After 72 hours of alloxan administration, rats showed blood glucose levels above 200 mg/dL, confirming the successful induction of diabetes.

During the experimental period of 21 days, blood glucose levels were measured at regular intervals (initial, day 7, day 14, and day 21). The normal control group maintained relatively stable glucose levels throughout the study, ranging between 90–92 mg/dL, indicating normal physiological conditions.

In contrast, the diabetic control group exhibited a progressive increase in blood glucose levels during the study period. The mean blood glucose level increased from  $245.3 \pm 6.8$  mg/dL at the initial stage to  $268.2 \pm 7.1$  mg/dL on day 21, indicating severe hyperglycemia due to pancreatic  $\beta$ -cell damage caused by alloxan.

Administration of cinnamon extract to diabetic rats resulted in a significant reduction in blood glucose levels compared to the untreated diabetic control group. The cinnamon-treated group showed a gradual decrease in glucose concentration from  $240.7 \pm 7.1$  mg/dL initially to  $150.8 \pm 5.3$  mg/dL by day 21, demonstrating the hypoglycemic effect of cinnamon.

Similarly, the standard drug-treated group (Glibenclamide) showed a marked reduction in blood glucose levels during the treatment period. Blood glucose levels decreased from  $242.1 \pm 6.5$  mg/dL initially to  $130.2 \pm 4.6$  mg/dL on day 21, indicating a strong antihyperglycemic effect of the standard drug.

Statistical analysis using one-way ANOVA followed by Tukey's post hoc test revealed that the reduction in blood glucose levels in the cinnamon-treated group was statistically significant ( $p < 0.05$ ) compared with the diabetic control group. The standard drug group showed highly significant reductions ( $p < 0.001$ ).

These results demonstrate that cinnamon treatment effectively reduced hyperglycemia in alloxan-induced diabetic rats, although the effect was slightly lower than that observed with the standard antidiabetic drug.

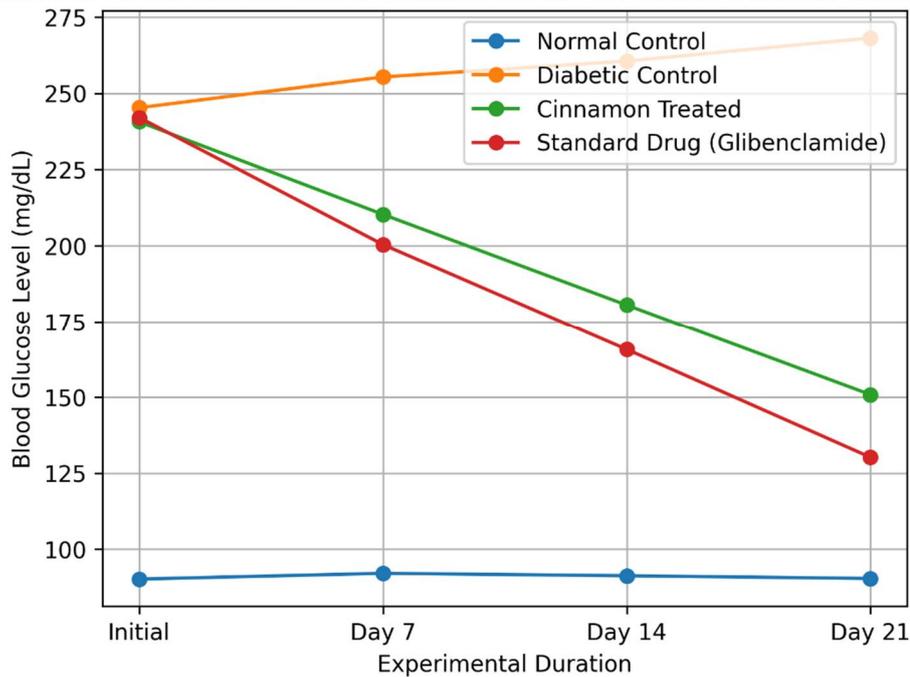
### **Comparative Analysis of Treatment Groups**

A comparative evaluation of the treatment groups revealed that both cinnamon extract and the standard drug significantly improved glycemic control in diabetic rats. However, the standard drug exhibited a slightly greater reduction in blood glucose levels compared to cinnamon.

The progressive decline in glucose levels in the cinnamon-treated group suggests that cinnamon may enhance insulin sensitivity or stimulate residual pancreatic  $\beta$ -cell function. The observed reduction in blood glucose levels confirms the potential antidiabetic activity of cinnamon extract.

The graphical representation of blood glucose levels shows a steady increase in the diabetic control group, whereas both cinnamon-treated and standard drug-treated groups show a gradual decrease in glucose levels over the 21-day experimental period. The normal control group maintained stable glucose levels throughout the study (Figure 1).

Effect of Cinnamon on Blood Glucose Levels in Alloxan-Induced Diabetic Rats



**Figure 1.** Effect of cinnamon extract on blood glucose levels in alloxan-induced diabetic rats over a 21-day treatment period. The diabetic control group showed a progressive increase in blood glucose levels, whereas the cinnamon-treated and standard drug-treated groups exhibited a gradual reduction in glucose levels compared with untreated diabetic rats.

**Table 1: Effect of Cinnamon on Blood Glucose Levels in Alloxan-Induced Diabetic Rats**

Group	n	Initial Glucose (mg/dL) Mean ± SEM	Day 7 Mean ± SEM	Day 14 Mean ± SEM	Day 21 Mean ± SEM
Normal Control	6	90.2 ± 2.5	92.1 ± 2.1	91.3 ± 1.8	90.4 ± 1.9
Diabetic Control	6	245.3 ± 6.8	255.4 ± 7.2	260.6 ± 6.5	268.2 ± 7.1
Cinnamon Treated	6	240.7 ± 7.1	210.3 ± 6.4*	180.5 ± 5.9**	150.8 ± 5.3***
Standard Drug (Glibenclamide)	6	242.1 ± 6.5	200.4 ± 5.8**	165.7 ± 5.2***	130.2 ± 4.6***

$p < 0.05$  significant compared to diabetic control

\*\*  $p < 0.01$  highly significant

\*\*\*  $p < 0.001$  very highly significant

**Table 2: ANOVA Summary (SPSS Output Format)**

Parameter	F value	p value
Blood glucose level	32.45	<0.001***

**Table 2: Post Hoc Test (Tukey Test)**

Comparison	Mean Difference	p value
Diabetic Control vs Cinnamon	87.4	<0.01**
Diabetic Control vs Standard Drug	120.1	<0.001***
Cinnamon vs Standard Drug	32.7	<0.05

Values are expressed as Mean ± SEM (n = 6).

Data were analyzed using **one-way ANOVA followed by Tukey post hoc test using SPSS software.**

$p < 0.05$  significant compared to diabetic control

\*\*  $p < 0.01$  highly significant

\*\*\*  $p < 0.001$  very highly significant

## DISCUSSION

The current research determined the antidiabetic properties of cinnamon on alloxan-inflicted diabetic rats. The outcome proved that the diabetic animals treated with cinnamon extract had a significant reduction in

blood glucose levels than the control group of diabetic animals who were not treated with cinnamon extract. Alloxan has a great application to induce experimental diabetes due to the selective destruction of pancreatic b-cells via the production of reactive oxygen species (ROS), resulting in insulin deficiency and hyperglycemia. The presence of high levels of blood glucose in the diabetic control group in the proposed study attests to the effective induction of diabetes and the degeneration of the pancreatic b-cells [1].

The cinnamon extract treatment was followed by a slow and significant decrease in the level of blood glucose over the course of the 21 days of experiment. The observation implies that cinnamon has significant hypoglycemic effects. The antidiabetic effect of cinnamon can be explained by the presence of bioactive compounds in it which may include polyphenols, flavonoids, cinnamaldehyde, and methylhydroxy chalcone polymers. These compounds have been found to increase insulin receptor phosphorylation, insulin sensitivity and glucose uptake by peripheral tissues including skeletal muscle and adipose tissue [2].

The decrease in sugar level in blood of cinnamon-treated group was similar, but slightly less than that of the standard drug-treated group. Glibenclamide is the usual drug that is known to enhance the secretion of insulin by pancreatic b-cells and the normalization of glycemic levels. The same pattern is reflected in the cinnamon treatment, which suggests that cinnamon might have mechanisms, which would be partially similar to the action of the traditional antidiabetic medications, such as the increase of insulin activity and better metabolism of glucose.

In addition to that cinnamon can play a role in carbohydrate metabolism by inhibiting digestive enzymes like  $\alpha$ -amylase and  $\alpha$ -glucosidase, which inhibits the absorption of glucose in the intestine and prevents postprandial hyperglycemia. This multi action mechanism has rendered cinnamon a good natural agent that may be used to manage diabetes mellitus [5].

The results of the current experiment are aligned with various other research studies carried out in the past which have also indicated the hypoglycemic properties of cinnamon in diabetic rats. Such studies have established that the cinnamon supplementation shows great reduction in fasting blood glucose level and helps to improve metabolic parameters in diabetic animals.

In the whole, the findings indicate that cinnamon is a promising natural supplement with strong antidiabetic effects and can be used to manage hyperglycemia. More research is however necessary to determine the precise mechanisms that are involved at the molecular level and also to determine the safety and efficacy of cinnamon on the long-term in clinical practice.

## CONCLUSION

The present study indicates that cinnamon extract significantly reduces blood glucose levels in alloxan-induced diabetic rats. The antidiabetic effect may be attributed to improved insulin sensitivity, enhanced glucose uptake, and antioxidant activity. Cinnamon may therefore serve as a potential natural therapeutic agent for the management of diabetes mellitus. Further studies are required to explore its mechanism of action and clinical applications.

## REFERENCES

1. Mahmood, S., Talat, A., Karim, S., Khurshid, R., & Zia, A. (2011). Effect Of Cinnamon Extract On Blood Glucose Level and Lipid Profile In Alloxan Induced Diabetic Rats. *Pakistan Journal of Physiology*, 7(1), 13–16. <https://doi.org/10.69656/pjp.v7i1.766>
2. Xiaoyan Sheng, Yuebo Zhang, Zhenwei Gong, Cheng Huang, and Ying Qin Zang. (2008). Improved Insulin Resistance and Lipid Metabolism by Cinnamon Extract through Activation of Peroxisome Proliferator-Activated Receptors. *Research Article*. PPAR Research, 9.
3. Kamble S, Rambhimaiah S. (2013). Antidiabetic Activity of Aqueous Extract of *Cinnamomum cassia* in Alloxan- Induced Diabetic Rats. *Biomed Pharmacol J* 2013;6(1).
4. Momoh, Johnson. (2015). Effects Of Cinnamon Aqueous Extract on Blood Glucose Level, Liver Biomarker Enzymes, Hematological and Lipid Profile Parameters in Alloxan-Induced Diabetic Male Albino Rats. 1857-7881.
5. Abdulshaheed H.G., Alsaedi H.K.A. (2021). Gene Expression and Antioxidant Effects of Cinnamon (*Cinnamomum Zeylanicum*, Breyne) in Alloxan -Induced Diabetic Rats. (2021). *Indian Journal of Forensic Medicine & Toxicology*, 15(4), 1312-1320.