

## Therapeutic Effect of Turmeric (*Curcuma longa* Linn.) Rhizome Fresh Root Juice in Alloxan Monohydrate Induced Type-1 Diabetes in Albino Rats

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### ABSTRACT

From time immemorial therapeutic potential of *Curcuma longa* is known. In present study an effort has been made to assess the hypoglycemic, anticholesterolmic, anti-ureatic, anti-creatinic and oral glucose tolerance test (OGTT) activity of *Curcuma longa* juice in alloxan monohydrate induced experimental animal model. Rats were acclimatized for 7 days in lab temperature. All animals were given standard water and pellet diet. Diabetes was induced in rats with the help of alloxan monohydrate (130 mg/kg body weight). After alloxan monohydrate injection rats were separated and treatment started with *Curcuma longa* juice and insulin. A marked rise in fasting blood glucose, serum cholesterol, serum creatinine, serum urea level was observed in diabetic control rats when compared to normal control rats. Anti-hyperglycemic, anti-cholesterolmic, anti-creatinic, anti-ureatic activity observed in *Curcuma longa* fresh root juice administered rats on 15<sup>th</sup>, 30<sup>th</sup>, 45<sup>th</sup> and 60<sup>th</sup> days post treatment. Anti-hyperglycemic, anti-cholesterolmic, anti-ureatic, anti-creatinic activity was found almost similar effect like insulin treatment group. It is hope that present investigation will be helpful in establishing a scientific basis for antidiabetic, anti-cholesterolmic, anti-creatinic, anti-ureatic effects in experimental animal model. The results are (<0.05) statistically significant.

**Keywords:** Diabetes, Blood glucose, Insulin, *Curcuma longa*, Serum, Urea, Creatinin

### INTRODUCTION

Incidence of diabetes mellitus in India will increasing at war foot levels. The disease affecting both rural and urban population at an alarming rate. Diabetes are a potentially devastating disease with high morbidity and mortality. The central identifying feature of diabetes is chronic and substantial elevation of the circulating glucose level and the underlying goal of all diabetes treatment and management are to maintain an optimum blood glucose level [1].

During the year 2019, India had 72.96 million people suffering from diabetes and after eleven years total number of diabetes has to be 98 million. Several oral and injectable anti-diabetic drugs are used in treatment of diabetes. The existing group of oral hypoglycemic drugs includes Sulphonylures, Biguanide alpha-glucosidase inhibitor, glucagon like peptide analogs, Dipeptidyl peptidase -4 inhibitors, PPAR- $\gamma$  agonist etc are in use. Recently SGLT 2 inhibitors (in kidney), Aldolase reductase inhibitors, agonists of fibroblast growth factors -21 (FGF-21) are being explored. Several side effects associated with the use of such oral or injectable hypoglycemic agent during or after treatment have

been reported [2,3]. But no any side effect associated with the use of herbal drugs [4,5]. There is growing interest in herbal remedies for diabetes, due to their availability and lesser side effects. Gradually increasing order of this disease effect, the society, for that medical sciences is busy to search some positive technology by which this abnormality can be deleted [6].

Dietary agents such as spices have been used extensively in the Eastern world for a variety of ailments for millennia, and

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five centuries ago, they took a golden journey to the Western world. Various spice- derived nutraceuticals including 1-acetoxychavicol acetate, anethole, capsaicin, cardamomin, Curcumin, dibenzoylthane, diosgenine, eugenol, gambogicacid, gingerol, thymoquinone, ursolic cid, xanthohumol and zerumbone derived from galangal, anise, red chili, black cardamom, turmeric, licorice, fenugreek, clove, kokum, ginger, black cumin, rosemary, hop and panecone ginger have been investigated. Although, they always been used to improve to taste and color and as a preservative, they are also used in the treatment of Diabetes Mellitus, but none of them could be developed as a drug for diabetics.

*Curcuma longa* L. (Zingiberaceae), commonly known as turmeric, is native to Southwest India. *Curcuma longa* generally used in treatment of indigestion, cough, arthritis, diabetes, blood purifier, menstrual irregularities [7] and antioxidant [8,9]. Present investigation was conducted to evaluate the anti-diabetic, anti-cholesteromic, anti-ureatic and anti-creatinic properties in alloxan monohydrate administered animals' model.

### Objective

To gain a scientific understanding of Turmeric roots therapeutic values and their efficacy in the treatment and management of the disease, diabetes.

### MATERIALS & METHODS

#### Plant materials

The Turmeric (*Curcuma longa* Linn.) used for present investigation. Turmeric fresh root was obtained from the local crop field of Darbhanga, India.

#### Juice of *Curcuma longa*

Firstly, *Curcuma longa* root was procured from crop field area and was cleaned and extracted the juice. Juice was administered with the help of intubation tube.

Male albino rats (200-250 g and 10-14 weeks) were used as experimental animals. Animals were procured from local supplier of Darbhanga, India.

The rats were acclimatized for 7 days. All the animals were fed with rodent pellet diet Water was allowed ad-libitum under strict hygienic condition.

### Induction of diabetes

Alloxan Monohydrate is a toxic glucose analogue which selectively destroys insulin producing cell in pancreas. This causes insulin dependent diabetes mellitus called "Alloxan Diabetes" [4]. Alloxan monohydrate was obtained from Explicit Chemicals Pvt. Ltd, Pune, India.

### Experimental design

1. Normal Control
2. Diabetic control
3. Alloxan +Curcuma longa Juice treatment
4. Alloxan + Insulin treatment

The diabetes was induced in 12 h fasted animal by a single intraperitoneal injection of freshly prepared solution of Alloxan monohydrate (135 mg/kg body weight) in 0.5 ml normal saline water.

After 72 h of Alloxan monohydrate injection, the diabetic rats (blood glucose levels <290mg/dl) were separated. Treatment was started except in normal control and diabetic control animals. During further investigation all experimental group animals were given standard hygienic water and pellet diet. Blood glucose were monitored with the help of digital glucometer (Dr. Morepen Gluco One).

### RESULTS & DISCUSSION

A significant increase in fasting blood glucose levels was measured in diabetic control (vehicle) when compared to normal rats. Anti- diabetic, anticholesteromic, anti-ureatic, anti-creatinic activity was recorded in *Curcuma longa* juice treated rats on 15<sup>th</sup>, 30<sup>th</sup>, 45<sup>th</sup> and 60<sup>th</sup> day post treatment. The serum cholesterol, serum urea and serum creatinine of diabetic control animals were higher than the other experimental group. Anticholesteromic, anti-ureatic, and anti-creatinic activity were recorded in juice and insulin administered animals. Oral glucose tolerance test was significantly tolerated administered glucose in juice treated animals compared to diabetic control group. Turmeric also improves the serum protein count when compared to diabetic control rats. The results are shown in **Tables 1, 2 and 3.**

**Table 1.** Effect of *Curcuma longa* Juice and Insulin on blood glucose level in experimental animal model.

Experimental Group	Fasting blood glucose level (mg/dl)			
	15 <sup>th</sup> Day	30 <sup>th</sup> Day	45 <sup>th</sup> Day	60 <sup>th</sup> Day
-Normal Rats	87.18 ± 2.83	88.18 ± 1.22	86.12 ± 1.38	85.19 ± 1.02
Diabetic Control (Vehicle)	298 ± 1.71	305.12 ± 2.12	306.22 ± 3.16	299.14 ± 0.87

<b>Alloxan+ Juice treatment (1200 mg/kg body weight)</b>	280.17 ± 0.67 P < 0.05	0.72 ± 2.12 P < 0.05	0.17 ± 2.18 p < 0.05	95.17 ± 2.16 p < 0.05
<b>Alloxan + Insulin (Human mixtard®)</b>	279.18 ± 1.67 P < 0.05	209.18 ± 3.14 P < 0.05	182.16 ± 2.19 P < 0.05	94.16 ± 0.18 P < 0.05
<b>Values are mean± SEM, N=6 P&lt;0.05 Vs diabetic Control</b>				

**Table 2.** Effect of Curcuma longa Juice and Insulin on biochemical profile (serum urea, serum creatinine, serum cholesterol).

Experimental Group	Serum urea (mg/dl)	Serum Creatinine (mg/dl)	Serum Cholesterol (mg/dl)	Serum Protein (mg/dl)
<b>Normal Rats</b>	34.01 ± 1.18	0.46 ± 0.09	100.42 ± 1.07	7.18 ± 0.18
<b>Diabetic Control (Vehicle)</b>	72.18 ± 3.08	1.68 ± 0.07	205.02 ± 2.86	4.87 ± 0.60
<b>Alloxan+ Juice treatment (1200 mg/kg body weight)</b>	33.14 ± 1.19 P < 0.05	55 ± 0.06 P < 0.05	105.02 ± 2.07 p < 0.05	8.20 ± 0.08 p < 0.05
<b>Alloxan + Insulin (Human mixtard®)</b>	35.15 ± 2.16 P < 0.05	0.62 ± 0.07 P < 0.05	107.03 ± 3.05 P < 0.05	7.01 ± 0.03 P < 0.05
<b>Values are mean± SEM, N=6 P&lt;0.05 Vs diabetic Control</b>				

**Table 3.** Effect of Curcuma longa Juice on oral glucose tolerance test (OGTT) in experimental diabetic albino rats.

Experimental Group	Fasting blood glucose level (mg/dl)				
	0 min	30 min	60 min	90 min	120 min
<b>-Normal Rats</b>	92.60 ± 2.60	190.18 ± 4.01	145.02 ± 2.08	110.20 ± 4.60	96.20 ± 2.20
<b>Diabetic Control (Vehicle)</b>	295.18 ± 7.60	330 ± 1.60	360 ± 1.20	340 ± 2.12	320.40 ± 2.20
<b>Alloxan+ Juice treatment (1200mg/kg body weight)</b>	95.06 ± 6.28 P < 0.05	18 ± 2.14 P < 0.05	136.17 ± 3.12 p < 0.05	132.18 ± 3.68 p < 0.05	95.20 ± 3.60 p < 0.05
<b>Alloxan + Insulin (Human mixtard®)</b>	109.06 ± 2.07 P < 0.05	240.26 ± 4.12 P < 0.05	209.18 ± 2.18 P < 0.05	116 ± 3.12 P < 0.05	119.7 ± 2.19 P < 0.05
<b>Value are mean ± SEM, N=6 P&lt;0.05 Vs diabetic Control.</b>					

Curcuma longa fresh root juice was found almost similar effect like insulin treatment group. The result of the present investigation indicates that Curcuma longa fresh root juice have the property to lowers the blood glucose, serum creatinine and serum urea levels. Alloxan monohydrate facilitates the production of free radicals and causes the tissue damage. The beta cells of pancreas are susceptible to such damage. It appears from the present investigation that the Curcuma longa fresh root juice might have tissue repairable and restorative capacities [10]. Research has also reported beet root juice treated rat showed reduction of blood glucose in alloxan monohydrate induced diabetic rats. Finding in this regard with Curcuma longa fresh root juice and beet root juice was also no different [11]. Research has reported that oral administration of aqueous extract of Curcuma longa root lead to marked lowering of blood glucose level in alloxan induced experimental model [12]. Scientists have also demonstrated that crude aqueous extract of Curcuma longa fresh root possess hypoglycemic properties in Alloxan administered animal model. Findings in the present study too are in accord with the findings discussed above; Curcuma longa fresh root juice has been widely used for curing various maladies. Present investigation will be helpful in establishing a scientific basis for anti-diabetic, anti-cholesteromic, anti-ureatic, anti-creatinic uses of Curcuma longa fresh root juice in alloxan induced experimental animal model. Curcuma longa fresh root juice tolerated the overdose of glucose through oral glucose tolerance test in juice treated experimental animals. However, much more studies are still required to explore the other potential of this fresh plant root.

*From the present investigation it is appeared that Curcuma longa fresh root juice might have some ingredients to increase the output of insulin by binding to the receptors of the beta cells of the Langerhans located in the pancreas. Once they bind to the sulphonylureas receptors, the K<sup>+</sup>-ATP channels are probably closed and therefore the membrane is depolarized, and insulin production is stimulated.*

However, there is a dearth of literature related to the effect of turmeric in experimental animal model especially those related to diabetes.

## CONCLUSIONS

It is hoped that present investigation will provide significant alternative therapies to diabetics. This therapy is not only to control blood glucose level but also account for all over improvement in the experimentally induced diabetic rats' condition.

This research appears that turmeric (Curcuma longa) works as anti-diabetic agent. So, this plant root will be helpful in treating the diabetes in rural Asian countries due to low cost, easily availability and no any side effects associated with the use of this plant root.

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