



## Role of Cumin in Management of Type 2 Diabetes Mellitus with respect to its Antidiabetic and Antioxidant Property

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### ABSTRACT

Diabetes Mellitus is one of the most common metabolic disturbances associated with carbohydrates, lipids, proteins and relative or absolute insulin depletion. Hyperglycemia in type 2 diabetes mellitus (T2DM) leads to the increased lipid peroxidation and decreased total antioxidant capacity followed by development of chronic complications due to oxidative stress. Cumin is one of the medicinal herbs which are being studied for antioxidant, antibacterial and antifungal effects. The purpose of this study was to evaluate the effect of cumin on glycemic status, oxidative stress and antioxidant capacity in patients with T2DM. Two hundred patients with T2DM were selected in the randomized control trial, of which 100 subjects were enrolled as the study group was given 500 mg of cumin powder in capsule form daily along with their antidiabetic drug medication (Metformin) for 3 months period while 100 subjects on medication of antidiabetic drug (Metformin) were selected as the control group. Fasting plasma glucose, serum levels of lipid peroxidation in the form of malondialdehyde (MDA) and Total Antioxidant Capacity (TAC) were measured at baseline and also after a period of 3 months intervention period. The result showed a significant reduction in fasting plasma glucose level (FPG), serum MDA and significant rise in serum TAC in study group by the end of 3 months of cumin supplementation period. Supplement action of cumin leads to improve antidiabetic, antioxidant and decrease oxidative stress in type 2 diabetes patients and could be useful in the management of T2DM.



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### INTRODUCTION

Diabetes is a metabolic disorder which leads to hyperglycemia due to impairment of insulin secretion, insulin function or both. Type 2 diabetes affects 90-95 % of people. The signs and symptoms of this disease are the elevated level of blood glucose, decreased peripheral absorption of glucose due to impairment of insulin secretion and peripheral resistance to insulin (Jafari *et al.*, 2017).

Several pathological processes are involved in the development of diabetes. Various long term complications of diabetes developed due to the chronic

hyperglycemia and insulin resistance. These complications are both macro and micro vascular abnormalities such as autonomic neuropathy, peripheral neuropathy, retinopathy, cardiovascular symptoms and nephropathy (Wold *et al.*, 2005; Rahimi *et al.*, 2005; Ganjifrockwala *et al.*, 2017).

Oxidative stress is responsible for the development of chronic complications of diabetes mellitus (Opara, 2002) and results from chronic hyperglycemia, increased oxidants and thereby decreased antioxidants.

Individuals suffering from diabetes are often started on medications such as Metformin and are seen frequently by their providers therefore have increasing medical expenses as well. Hence to reduce the long term cost of medication to control diabetes, new cost effective alternative supplementation help to reduce long term side effects and expenses for diabetes (Mansouri *et al.*, 2018).

As late as now, many plants have been tested and used in the prevention and management of diabetes. Spices form an important class of food adjunct in human diet. Besides increasing the taste and flavor of foods, spices illustrated a broad range of physiological and pharmacological properties (Babu and Srinivasan, 1997). Cuminum cyminum (cumin) belongs to Apiaceae family. The native regions for this plant are India, Iran, the Mediterranean and Egypt. This plant has antioxidant and antidiabetic properties (Thippeswamy and Naidu, 2005; Patil *et al.*, 2013). The effective component of cumin is cuminaldehyde or 4 - isopropyl Benzaldehyde which is the enzyme inhibitor of  $\alpha$ -glucosidase and aldol reductase of carbohydrate metabolism. It is possible that the antidiabetic property of cumin is due to the existence of these enzyme inhibitors (Lee, 2005).

An imbalance between the generation of reactive oxygen and protective mechanisms results in oxidative stress (West, 2000). Free radicals are the main cause of oxidative stress that reacts with variety of biomolecules including lipids, carbohydrates, proteins, nucleic acids (Halliwell, 1994; Rahbani-Nobar *et al.*, 1999).

In diabetes mellitus, defense mechanism is disturbed and unproductive scavenging of reactive oxygen species (ROS) and reactive nitrogen species (RNS) plays an imperative role in causing tissue damage in the diabetic patients (Valko *et al.*, 2007). The increased frequency of free radicals result in the activation of stress signaling pathways and exhausts both enzymatic and non-enzymatic antioxidants, which lead to a negative impact on the quality of life and lifespan of diabetic patients (Ganjifrockwala

*et al.*, 2017).

Diminished antioxidant activity of the enzymes and decrease in total antioxidant capacity may raise the susceptibility of diabetic patients to oxidative stress. A proper support for enhancing antioxidant supplies may help to prevent the complications in patients with type 2 diabetes mellitus.

The recent research indicated that, cumin has positive and significant effect on blood glucose and total antioxidant capacity in type 2 diabetes patients (Andallu and Ramya, 2007; Dhandapani *et al.*, 2002).

There is a need for more pervasive/comprehensive study to assess the effects of cumin in patients with type 2 diabetes mellitus. Therefore the purpose of this study is to evaluate the effects of cumin on blood glucose, serum MDA and total antioxidant capacity in patients with type 2 diabetes mellitus.

## MATERIALS AND METHODS

The study was carried out in the Department of Biochemistry, Krishna Institute of Medical Sciences, Karad (Western Maharashtra). The study was approved by Institutional Ethics Committee. This study was carried out in the form of randomized control trial which includes all type 2 diabetic patients referred to Krishna Hospital and Medical Research Centre, Karad. The total of 200 subjects with type 2 diabetes were enrolled into two groups with 100 subjects in each group, including one study group and one control group. The objectives of the study and risk factors were explained to volunteers after which their written informed consents were obtained.

### Inclusion criteria

Non insulin dependent type 2 diabetics aged between 35-65 years, having single drug schedule for this treatment.

### Exclusion criteria

Patients with pregnancy, breastfeeding, using tobacco, alcohol, consuming thyroid, hypolipidemic, antihypertensive and anticoagulant drug medications were excluded.

The study group was given one capsule of 500 mg cumin powder daily post-lunch for 3 months period. During study period, antidiabetic drug medication (Metformin) was sustained as usual and subjects were advised to maintain their normal diet and physical activity.

Overnight fasting blood sample was collected from each subject at baseline and after 3 months inter-

**Table 1: Showing Levels of Fasting Plasma Glucose (FPG), Serum Malondialdehyde (MDA) and Serum Total Antioxidant Capacity (TAC) in Control and Study Group at Baseline and After 3 Months Intervention of Cumin**

Variable	Parameter	Baseline Mean $\pm$ SD	After 3 Months period Mean $\pm$ SD	Difference Mean $\pm$ SD	Paired 't'	Paired 'P'
Control Group	FPG	149 $\pm$ 19.69	146 $\pm$ 19.46	2.74 $\pm$ 8.28	3.311	0.0013
		153 $\pm$ 22.97	141 $\pm$ 14.18	12.67 $\pm$ 21.40	5.922	<0.0001
Unpaired 't' & 'P'		t=1.372 P=0.1716	t=2.397 P=0.0174			
Control Group	MDA	12.16 $\pm$ 2.67	10.59 $\pm$ 3.16	1.57 $\pm$ 2.49	6.303	<0.0001
		11.88 $\pm$ 2.67	9.52 $\pm$ 2.77	2.37 $\pm$ 3.08	7.672	<0.0001
Unpaired 't' & 'P'		t=0.7282 P=0.4674	t=2.548 P=0.0116			
Control Group	TAC	1303 $\pm$ 360.57	1366 $\pm$ 261.32	62.33 $\pm$ 153	4.069	<0.0001
		1305 $\pm$ 372.58	1391 $\pm$ 254.06	86.50 $\pm$ 330	2.617	0.0103
Unpaired 't' & 'P'		t=0.014 P=0.9887	t=2.299 P=0.0226			

vention period. The collected samples were immediately centrifuged at 3000 rpm for 10 minutes and were analyzed for fasting plasma glucose (FPG), serum malondialdehyde (MDA) as lipid peroxidation index and serum total antioxidant capacity (TAC).

Data were analyzed using paired and unpaired 't' test and values were expressed as Mean  $\pm$  Standard Deviation.

## RESULTS AND DISCUSSION

The results from table 1 indicated that, significant difference in FPG was observed in controls when compared between baseline and after cumin intervention for 3 months period (P=0.0013). Also significant difference was found in FPG in study group when compared between baseline and after 3 months cumin intervention (P<0.0001) (Table 1).

Further, significant difference in FPG was observed when compared between control and study group at baseline (P=0.1716) and after 3 months intervention of cumin (P=0.0174) (Table 1).

It was found a significant decrease in serum MDA in both control and study group (P<0.0001) when compared between baseline and after 3 months inter-

vention period (Table 1).

Extremely significant decrease was found in serum MDA of control and study group when compared between baseline (P=0.4674) and after 3 months intervention (P=0.0116) (Table 1).

We found significant increase in serum TAC in control group when compared between baseline and after 3 months intervention (P<0.0001). Also significant increase in TAC was observed in study group when compared between baseline and after 3 months intervention (P=0.0103). (Table 1).

There was significant difference found in serum TAC in control and study group when compared between baseline (P=0.9887) and after 3 months intervention period (P=0.0226) (Table 1).

The results of this study showed that, a significant difference of serum FPG found in control and study groups between the baseline and after 3 months cumin intervention period. Also it was found significant decrease in serum MDA and significant increase in serum TAC when compared between baseline and after 3 months intervention period in control and study groups.

Cumin seeds were found to recover glycemic status in type 2 diabetes patients. The study was

included 94 subjects randomly divided into three groups receiving different doses of the cumin seeds (1, 2, or 3 grams per day) for three months period. The subjects with supplementation of 2 grams of cumin seeds per day were found to be the significant reduction in blood glucose by the end of eight weeks (Bamosa *et al.*, 2010).

Thus the authors concluded from their study that, a supplementation of 2 gm of cumin per day might be beneficial to oral hypoglycemic agents in type 2 diabetic patients.

Black cumin had an anti-diabetic effect which appeared to improve insulin sensitivity (Benhaddou-Andaloussi *et al.*, 2011).

B. Andallu, V. Ramya (2007) found that, a significant ( $p < 0.05$ ) decrease (25%) in fasting glucose levels and was observed in experimental diabetics i.e., treated with cumin seeds while such decrease was not observed in control subjects treated with the drug.

Cumin has antioxidant property and it has been used in traditional medicine as a stimulant, carminative and anticoagulant. From various researchers, it has been proved that cumin has antidiabetic property also (Jafari *et al.*, 2017).

Fibres present in cumin seeds (12%) might have contributed to the observed effect as fibres were reported to slow down stomach emptying, delay and attenuate the post prandial raise in blood glucose. In addition, ascorbic acid, niacin, copper and manganese present in cumin seeds were reported to exhibit anti-diabetic effect (Andallu and Ramya, 2007).

Polyphenolic compounds found in plants such as anthocyanins, flavones, flavones, phenolic acids, etc. possess a potent radical scavenging activity (Nair *et al.*, 2013).

Polyphenolic compounds are abundantly found in cumin, which exhibits strong antioxidant capacities and could effectively substitute the synthetically generated antioxidants which are incorporated in food and offer supplementary benefits to health (Nadeem and Riaz, 2012).

There are several different mechanisms through which the phenolic compounds, showed their antioxidant properties such as radical scavenging activity, metal ions chelation and inhibition of enzymes that are responsible for free radical generation.

The researchers have found that, various studies on cumin seeds proved antioxidant properties either by radicals scavenging property, metal ions chelat-

ing or by inhibiting enzymes of free radical generation (Phatak *et al.*, 2015; Hendre and Phatak, 2018; Salazar *et al.*, 2008).

We observed similar findings in our study which clearly pointed out that, there might be a strong correlation between antidiabetic and total antioxidant activity found in cumin which could be a better supplementation in management of type 2 diabetes mellitus.

## CONCLUSIONS

In the present study, effects of cumin in improvement of plasma glucose, serum MDA and TAC were observed. From the noteworthy results in the present study, it is concluded that, cumin supplementation can be helpful in the management of type 2 diabetes mellitus.

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## Conflict of Interest

The authors declare that they have no conflict of interest.

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