

A REVIEW

Role of spices in diabetes mellitus

■ Parul Bora

SUMMARY

Diet has been recognised as a corner stone in the management of diabetes mellitus. Drug, diet and recently spices therapies are the major approaches used for the treatment and control of diabetes mellitus. Spices are the common dietary adjuncts that contribute to the taste and flavour of foods. Besides, spices are also known to exert several beneficial physiological effects including the antidiabetic influence. Dietary spices influence various systems in the body such as gastrointestinal, cardiovascular, reproductive and nervous systems resulting in diverse metabolic and physiologic actions. An attempt has been made in this review to focus on the traditional use of dietary spices based on factual research evidence for their multivalent actions as health promoting dietary additives as well as putative therapeutic agents especially in diabetes mellitus.

Key Words : Spices, Diet, Diabetes mellitus, Physiological effects

How to cite this article : Bora, Parul (2022). Role of spices in diabetes mellitus. *Internat. J. Plant Sci.*, 17 (1): 105-108, DOI: 10.15740/HAS/IJPS/17.1/105-108, Copyright@ 2022:Hind Agri-Horticultural Society.

Article chronicle : Received : 04.08.2021; Accepted : 07.12.2021

Diabetes mellitus is a global disease, prevails all over the world, through the prevalence rate differ from country to country. Diabetes, a disorder of carbohydrate metabolism, is characterized by high blood glucose level and glycosuria resulting from dysfunction of pancreatic beta cells and insulin resistance. In advance stages of diabetes, metabolism of protein and lipid is also altered. Many factors like heredity, age, obesity, diet, sex, sedentary lifestyle, socio-economic status, hypertension and various stresses are involved in the etiology of diabetes mellitus (Khan and Safdar, 2010). Drug, diet

and recently spices therapies are the major approaches used for treatment and control of diabetes mellitus (Kocchar, 2018). This review attempts to focus on the traditional use of dietary spices based on factual research evidence for their multivalent actions as health promoting dietary additives as well as putative therapeutic agents. The history of dietary prescriptions dates back, perhaps to the origin of human race. Plants have been natural and traditional sources of medication in different dietary cultures all over the world and the use of seasonings and flavouring agents has been the mainstay of indigenous remedies across the world (Pruthi, 1976).

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Spices and diabetes mellitus:

Spices are known to exert several beneficial

physiological effects including the antidiabetic influence via short term hypoglycaemia and long term improved glucose tolerance (Sarkar and Pant, 2019; Viles *et al.*, 1995 and Sharma, 1986). A number of condiments and spices including pepper, asafoetida, aloes, ocimum and eugenol from Jamun (Jambu) have been ascribed a hypoglycaemic action in normal as well as experimentally induced diabetic animal models and also in humans. (Wang and Ng, 1999; Kedar and Chakravarty, 1982; Khan *et al.*, 1995; Jain and Vyas, 1975; Singh, 2015; Akhtar, 1992; Bhardwaj *et al.*, 1994, Kohli and Singh, 1993 and Tammurra and Ritter, 1994). Recent studies have cited evidences from animal experimentation as well as clinical trials where spices, their extract or active principle were examined for treatment of diabetes. Fenugreek seeds (*Trigonella foenumgraecum*), garlic (*Allium sativum*), onion (*Allium cepa*) and turmeric (*Curcuma longa*) have been experimentally documented to possess potential to function as antidiabetic agents (Viles *et al.*, 1995, Sharma 1986 and Wang and Ng, 1999). Cumin seeds (*Cuminum cyminum*), ginger (*Zingiber officinale*), mustard (*Brassica nigra*), curry leaves (*Murraya koenigii*) and coriander (*Coriandrum sativum*) have also been reported to have hypoglycaemic effects (Viles *et al.*, 1995 and Khan *et al.*, 1995). A comprehensive detail discussion is given regarding the hypoglycaemic effect reported on these spices as follows:

Cinnamon (*Cinnamomum zeylanicum*):

Various spices display insulin – potentiating activity *in vitro* and in particular, cinnamon spice and its phenolic extracts. Cinnamon ingestion reduced total plasma glucose responses as measured by area under the curve (AUC) to oral glucose ingestion as well as improved insulin sensitivity. Cinnamon supplementation may thus be important to *in vivo* glycemic control and insulin sensitivity in humans and not only are its effects immediate, they also appeared to be sustained for 12 hour. Cinnamon also significantly delayed gastric emptying and profoundly lowered post prandial glycemic responses without any significant effect on satiety (Solomon and Blannin, 2007 and Hlebowicz *et al.*, 2007).

Cumin seeds (*Cuminum cyminum*):

Oral administration of cumin for 6 weeks to diabetic rats resulted in significant reduction in blood glucose and body weight. Cumin supplementation was found to be more effective than glibenclamide in the treatment of diabetes mellitus (Dhandapani *et al.*, 2002).

Curry leaves (*Murraya koenigii*) and mustard (*Brassica nigra*):

Iyer and Mani in 2009, studied the effect of curry leaves (bay leaves) supplementation on lipid glycated protein and amino acids in 30 non-insulin dependent diabetes mellitus patients. The results indicated a transient reduction in fasting and postprandial blood sugar levels with no appreciable change in other parameters. Both *Murraya koenigii* and *Brassica nigra* showed significant hypoglycaemic action in experimental rats. There was increase in the concentration of hepatic glycogen and glycogenesis, as evident from the decreased activity of glycogen phosphorylase and gluconeogenic enzymes. Many enzymes of the liver including gluconeogenic, enzymes have been reported to be affected by spices both *in vitro* cell culture system as well as *in vivo* in experimental animals. The levels of glucose 6 phosphate dehydrogenase, the ability of insulin to activate lipoprotein lipase activity and also the effect of long term spice ingestion on these lipotropic effects could be responsible for the net hypoglycaemic effects indicating a more efficient optimal utilization of dietary carbohydrates on intake of spices (Khan *et al.*, 1995; Jain and Vyas, 1975 and Singh, 2015).

Fenugreek seeds (*Trigonella foenumgraecum*):

Rahuram *et al.* (1994) observed the hypoglycaemic effect of fenugreek seeds in 15 NIDDM subject. Incorporation of fenugreek in diet produced a significant fall in fasting blood glucose and improvement in glycogen tolerance, by improving peripheral glucose utilization (Rahuram *et al.*, 1994 and Mishkinsky *et al.*, 1976).

Garlic (*Allium sativum*) and onion (*Allium cepa*):

According to the studies performed by Koch and Lawson, both onion and garlic were found to possess hypoglycaemic activity (Koch and Lawson, 2016).

Sumac (*Rhus coriaria* L.) and black cumin (*Bunium persicum* Boiss):

The hypoglycaemic mechanism of efficacy of sumac and black cumin was investigated and the inhibition of a glycoside hydrolase- alpha amylase may have interest in the treatment and prevention of hyperglycemia and diabetes as well as dyslipidemia and obesity (Giancarlo *et al.*, 2006).

Turmeric and curcumin (*Curcuma longa*):

Administration of turmeric or curcumin to alloxan

diabetes rats reduced the blood sugar, haemoglobin and glycosylated haemoglobin levels. Turmeric and curcumin supplementation also reduced the oxidative stress encountered by these diabetic rats as demonstrated by the lower levels of TBARS (thiobarbituric acid reactive substance) which may have been due to the decreased influx of glucose into the polyol pathways leading to an increased NADPH/NADP ratio and elevated activity of the potent antioxidant enzyme GPx. Moreover, the activity of sorbitol dehydrogenase which catalyses the conversion of sorbitol to fructose, was lowered significantly on treatment with turmeric or curcumin (Arun and Nalini, 2002).

Conclusion :

Spices are food adjuncts that have been used as flavouring and coloring agents and as preservatives for thousands of year. Spices have also been recognized to possess medicinal properties and their use in traditional systems of medicine has been on record for a long time. With the advancement in the technology of spices and on knowledge of the chemistry and pharmacology of their active principle, their health benefits effects were investigated more thoroughly in recent decades. Much health benefit attributes of these common food adjuncts have been recognized in the past few decades by pioneering experimental research involving both animal studies and human trials. These studies documented digestive stimulant action, hypolipidemic effect, antidiabetic influence, antilithogenic property, antioxidant potential, anti-inflammatory property, antimutagenic and anticarcinogenic potential of spices. Among these, the hypocholesterolemic and antioxidant properties of a few specific spices have far reaching nutraceutical value. These beneficial physiological effects also have the potential of possible therapeutic application in a variety of disease conditions.

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