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Role of Spices in Diabetes Mellitus

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ABSTRACT

Diet has been recognized as a corner stone in the management of diabetes mellitus. Drug, diet and recently spices therapies are the major approaches used for treatment and control of diabetes mellitus. Spices are the common dietary adjuncts that contribute to the taste and flavor 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.

Keywords: Spices, diet, diabetes mellitus, natural products

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INTRODUCTION

Diabetes mellitus is a global disease, prevails all over the world, though the prevalence rate differs 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 life style, socio economic status, hypertension and various stresses are involved in the etiology of diabetes mellitus [1]. Drug, diet and recently spices therapies are the major approaches used for treatment and control of diabetes mellitus [1]. 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 the 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 flavoring agents has been the mainstay of indigenous remedies across the world [2-10].

Spices and Diabetes Mellitus

Spices are known to exert several beneficial physiological effects including the antidiabetic influence via short term hypoglycemia and long term improved glucose tolerance [11-13]. A number of condiments and spices including pepper, asafetida, 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 [14-22]. Recent studies have cited evidences from animal experimentation as well as clinical trials where spices, their extracts or their active principles 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 [12-14]. 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 [12,16]. A comprehensive detail discussion is given regarding the hypoglycemic 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* glycaemic control and insulin sensitivity in humans and not only are its effects immediate, they also appear to be sustained for 12 hour. Cinnamon also significantly delayed gastric emptying and profoundly lowered postprandial glycaemic response without any significant effect on satiety [23,24].

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 [25].

Curry leaves (*Murraya Koenigi*) and Mustard *(Brassica nigra)*

Iyer and Mani 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 [26]. Both *Murraya koenigii* and *Brassica nigra* showed significant hypoglycemic 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 systems as well as in vivo in experimental animals. The increased 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 carbohydrate on intake of spices [16-19].

Fenugreek Seeds (*Trigonella foenumgraecum*)

Rahuram *et al.* observed the hypoglycemic effect of fenugreek seeds in 15 NIDDM subjects. Incorporation of fenugreek in diet produced a significant fall in fasting blood glucose and improvement in glucose tolerance, by improving peripheral glucose utilization [27-28].

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

According to the studies performed by Koch and Lawson, both onion and garlic were found to possess hypoglycemic activity [29].

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 [30].

Turmeric and curcumin (*Curcuma longa*)

Administration of turmeric or curcumin to alloxan diabetic rats reduced the blood sugar, hemoglobin and glycosylated hemoglobin 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 substances) which may have been due to the decreased influx of glucose into the polyol pathway 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 [31].

CONCLUSION

Spices are food adjuncts that have been used as flavoring and coloring agents and as preservatives for thousands of years. 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 principles, their health benefit 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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