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FUNCTIONAL FOODS IN DIABETES MANAGEMENT & INDIAN SCENARIO

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KEYWORDS :

INTRODUCTION

Diabetes, a major global public health problem currently affecting 463 million individuals and projected to affect 700 million by 2045. Currently, in India, 77 million adults have diabetes and this number is expected to almost double to 134 million by 2045. The population of India, while at the epicentre of the global diabetes epidemic, has a lower BMI distribution and lower overall life expectancy; Indians also show a comparatively higher propensity to develop diabetes, both at younger ages and lower BMI levels, suggesting a substantially different epidemiology. [1]

In spite of availability of many pharmacological interventions including oral hypoglycemic agents and insulin therapy for diabetes management, present evidence shows an alarming rising trend in the occurrence of undesirable complications among these patients. [2]

Suitable prevention strategies have primarily focused on lifestyle interventions involving physical activity as well as diet strategies focused on pre-diabetes and high-risk individuals, and conclusively show a significant reduction in T2DM incidence rate from 28% to 58% around the world. Such importance of lifestyle prevention makes it essential to investigate the protective role of healthy nutrients and foods. The term "functional foods" has been coined indicating that such foods have been scientifically proven to have potential health benefits and those foods with biologically active ingredients are considered functional because of their association with physiological health benefits related to the prevention of several chronic diseases such as T2DM. [3]

Whole grains

Grains and cereal-based products are the basic sources providing energy and carbohydrate in diets. As the dietary carbohydrate sources in type 2 diabetic patients play a significant role in glycemic and insulin secretary response, the use of functional grains including whole grain cereals, and bakery products prepared using whole wheat, rye, oat, and barley is the first step in planning of a functional foods-based diet. [4]

As compared to refined grains, whole grains have more non-digestible complex polysaccharides including soluble and insoluble fibers, inulin, β-glucan, and resistant starches, as well as non- carbohydrate functional components including carotenoids, phytates and phytoesterogens, phenolic acids (ferulic acid, vanilic acid, caffeic acid, syringic acid, P-cumaric acid), and tocopherols. The protective effects of whole grain-based products against obesity, type 2 diabetes, cardiovascular diseases, hypertension, metabolic syndrome and several types of cancer, have been attributed to these bioactive compounds. [4]

Long-term follow-ups of diabetic patients indicate that higher consumption of whole grain, cereal fiber, bran, and germ were associated with decreased all-cause and cardiovascular disease-cause mortality. [4]

Phytochemical-Rich Fruits And Vegetables

Fruits and vegetables modification in diet is a definitely a significant strategy for management of type 2 diabetes and prevention of its complications; several studies indicate that regular consumption of various fruits and vegetables in diabetic patients can lead to an improved glycaemic control, reduced HbA1c and triglyceride levels, enhanced antioxidant defence system, attenuated oxidative stress and inflammatory markers, decreased risk of diabetic retinopathy, and a lower burden of carotid atherosclerosis. As various fruits and vegetables provide many different micronutrients and bioactive compounds, consuming varied fruits and vegetables is mainly recommended; it is noteworthy that the color of fruits and vegetables reflects predominant pigmented phytochemicals, and considering the colors in selection of these food groups provide a wide range of nutraceuticals. [4]

Examples of foods or food ingredients that may potentially be considered as "functional" in the field of blood glucose control. [5]

Food/ingredient	Target functions	Measurements
Low glycemic index starchy foods Low-saturated fat foods Whole grains Low-fat dairy products	Insulin sensitivity	Plasma insulin, HOMA index, glucose clamp
Low-glycemic-index starchy foods Fruit and vegetables	Glucose metabolism	Postprandial plasma glucose

Legumes

Legumes (peas, beans, lentils, peanuts) are important sources of dietary protein, non-digestible carbohydrates including dietary fiber, resistance starches, oligosaccharides, and bioactive compounds such as functional fatty acids (linoleic acid, α-linolenic acid), isoflavones (daidzein, genistein, glycitein), phenolic acids, saponins, and phytic acid; some polyphenols including pelargonidin, cyanidin, delphinidin, and malvidin are also found in legumes. There is evidence showing that regular consumption of legumes has protective effects against obesity, type 2 diabetes, and cardiovascular disease. α-amylase inhibitory peptides, the bioactive compounds in legumes and beans are the one that reduce digestion and absorption of dietary carbohydrates, and modulate postprandial glycemic response; other bioactive peptides includes 7S globulin α chain and conglutin γ have unique properties to regulate lipid metabolism and normalize lipid and lipoprotein levels. Low glycemic index, high fiber and phytochemical content of legumes make them functional food for diabetic patients. [4]

Nuts

Nuts play a protective effect against cardiovascular disease risk factors. Almonds, pistachios, walnuts and hazelnuts are commonly used nuts and are considered as functional foods that are rich sources of high-biological value proteins, bioactive peptides, functional fatty acids (mono and poly unsaturated fatty acids), fiber, phytosterols, polyphenols, tocopherols and other antioxidant vitamins; the antioxidative effect of nuts mainly is related to a high content of α and γ tocopherol, phenolic acids, melatonin, oleic acid and selenium, while the anti-inflammatory effect is related to ellagic acid, α-linolenic acid and magnesium. [4]

The evidence reveals that consumption of nuts in type 2 diabetes improves the overall diet quality and hence has beneficial effects on postprandial glycemic response following high-carbohydrate meals, attenuates postprandial oxidative stress and inflammatory processes, normalizes lipid and lipoprotein levels and decreases lipid atherogenicity, and improves insulin resistance. [4]

FUNCTIONAL FOODS FROM INDIAN CONTEXT

India has been recognized all over the world for spices and medicinal plants. They exhibit a wide range of physiological and pharmacological properties. Many of the traditional Indian foods are known as a functional food, because of its rich in substances that installation of a functional impact as Grains, Legumes, Spices, Turmeric, Fenugreek Seed, Saffron, Garlic, Ginger, Fruits, Root Tuber Crops, and Fermented Foods. [6]

Among spices, the natural food adjuncts that have been evaluated in this context, fenugreek seeds, garlic and onion, and their sulfur compounds, turmeric and its yellow principle, curcumin, have been reported to be effective in improving the glycemic status and glucose tolerance in diabetic animals and type 2 diabetic patients. [7]

Fenugreek :

The addition of fenugreek seeds to the diets of diabetic patients or animals reported a fall in blood glucose and improvement in glucose tolerance. The hypoglycemic effect is credited to the fiber and gum, which constitute as much as 52% of the seeds. The fiber-rich fenugreek is thought to delay gastric emptying by direct interference with glucose absorption. [7]

Garlic and Onion :

Both these spices have demonstrated hypoglycemic effect in different diabetic animal models and in limited human trials. The hypoglycemic potencies of garlic and onion are attributed to the disulfide compounds present in them, di(2-propenyl) disulfide and 2-propenylpropyl disulfide, respectively, that causes direct or indirect stimulation of insulin secretion by the pancreas. [7]

Turmeric :

Another spice that is claimed to possess beneficial hypoglycemic effects and to improve glucose tolerance in a limited number of studies is Turmeric. Dietary curcumin (of turmeric) and onion have been found to have a promising ameliorating influence on the severity of renal lesions in animal diabetic models. The hypocholesterolemic effect of these spices and their ability to lower lipid peroxidation under diabetic conditions is implicated in the amelioration of renal lesions. [7]

CONCLUSION

Functional foods represent a valid option in consumers' choices, ensuring biological properties that contribute to a healthier nutrition for Diabetes management. In present scenario, looking at the complications of diabetes, and ineffectiveness of current medications, there seems to be a need of other complementary approaches. Functional foods along with exercise is one of the new ray of hope of control the complications of diabetes. Functional foods and their bioactive compounds could reduce carbohydrate metabolism and hyperglycemia, improve pancreatic β-cell function and insulin secretion and insulin resistance, regulate lipid and lipoprotein metabolism and adipose tissue metabolism, modulate oxidative/ antioxidative balance and inflammatory processes, improve weight management and prevent micro and macro vascular complications.

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