



Role And Importance Of High Fiber In Diabetes Management In India

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Abstract:

India is facing a triple burden of pre-diabetes, diabetes, and obesity. Unhealthy eating habits and physical inactivity have been linked to the onset and progression of type 2 diabetes mellitus (T2DM). Despite dietary recommendations, individuals consume inadequate amounts or unsuitable type of dietary fiber (DF) which needs correction. Evidence has shown that medical nutrition therapy (MNT) is a valuable approach and an essential component of T2DM prevention and management. Studies have shown that fiber rich diabetes nutrition (FDN) has multi-systemic health benefits, including, improvement in glycemic control, reduction in glucose spikes, decrease in hyperinsulinemia, improvement in plasma lipid concentrations and weight management in T2DM patients. A high fiber diet is vital for people with diabetes and associated conditions. Increasing fiber intake, preferably through food or through dietary supplement, may help. Fiber rich diabetes nutrition (FDN) is recommended in order to prevent and manage T2DM.

Key words: Diabetes, Hyperinsulinemia, Supplement, Nutrition, Multi-systemic.

INTRODUCTION:

India contributes significantly to the global diabetes epidemic, with the second highest diabetes population in the world (Aravinda 2021). The prevalence is estimated to increase from 425 million people in 2017 to 629 million by 2045 (Forouhi et al 2018; Kapoor et al 2021). Similar trend estimates the increasing burden of pre-diabetes (Forouhi et al 2018; Anjana et al 2017) and obesity in India (Kalra & Unnikrishnan 2012; Shannawaz & Arokiasamy 2018; Kumar et al 2016). Sugar and sweet consumption continue to be popular and intrinsic to Indian culture & traditions (Gulati & Misra 2014). Escalation of diabetes burden is taking place rapidly in India and this may be, due to strong genetic factors coupled with urbanization and lifestyle changes leading to insulin resistance. The major contributor to insulin resistance may be “Asian Indian Phenotype”, consisting of higher rates of central obesity and increased visceral fat (Mohan 2004; Tandon et al 2018). Country is experiencing rapid changes in nutritional habits and a shift in dietary patterns to more ‘modern’ diets leading to low intake of fiber and excess consumption of calories, refined carbohydrates, saturated fats and sugar. This dietary transition and a sedentary lifestyle have significantly contributed to an increase in T2DM and obesity predominantly in urban, but also in rural areas (Shetty 2002; Misra et al 2011).

Intensive lifestyle interventions are the cornerstone in the prevention and management of diabetes. Prospective studies such as, Indian Diabetes Prevention Program (Ramachandran et al 2006), Diabetes Prevention Program (Weber et al 2016) and Look Ahead trial (2010) have shown that lifestyle modification strategies involving changing dietary patterns and or increasing physical activity helps in deferring the progression of pre-diabetes to diabetes (Edwardson et al 2014). The American Diabetic Association (ADA), Research Society for the Study of Diabetes in India (RSSDI), and Indian Council of Medical Research (ICMR) current T2DM clinical practice guidelines underline the need of using MNT as a first-line therapy and provide consistent nutritional recommendations for daily nutritional needs (ICMR guidelines 2018; Chawla et al 2020; Evert et al 2019).

The major goal of MNT is to achieve and maintain individualized glycemic targets, lipid and weight management goals, delay or prevent cardiovascular risk factors, for all adults with diabetes or prediabetes (Viswanathan et al 2019). DF is an important component of overall strategy to achieve MNT goals (Gray and Threlkeld 2012) and FDN is recommended for effective management of diabetes. Dietary fiber role & types DF is defined differently throughout the world. Some definitions are based on analytical methods for isolating fiber, while others move to define fiber on a physiological basis. Traditionally, dietary fiber is the edible parts of plants, or similar carbohydrates, that are resistant to digestion and absorption in the small intestine. In addition, properties of fiber, such as viscosity and fermentability, may be more important characteristics in terms of physiological benefits (Slavin 2013). DF is classified into two categories based on properties, sources, and their effects:

1. Soluble fiber is water soluble forming viscous gels. All soluble fibers, lead to delayed gastric emptying, which ultimately results in increased satiety and helps in weight loss (Weickert and Pfeiffer 2018).
2. Insoluble fibers are not water soluble. Due to their insolubility in water, they do not form gel and fermentation is restricted (Weickert and Pfeiffer 2018). Dietary fiber types, sources and their effects are presented in (Weickert and Pfeiffer 2018; Singh and Singh 2015).

The physiologic effect of dietary fiber is depicted (Weickert and Pfeiffer 2018; Soliman 2019). High-fiber diet delays the absorption and digestion of carbohydrates, and thereby decreases postprandial hyperglycemia. It is also shown to increase satiety, resulting in weight loss. Possible mechanism of action in insulin-resistant individuals could be through short-chain fatty acids (SCFA). The SCFAs are a byproduct of DF fermentation by certain microbes in the intestinal colon, and they have anti-inflammatory actions on both gut epithelial and immune cells (Weickert and Pfeiffer 2018; Soliman 2019; McNabney and Henagan 2017).

Benefits of high fiber diet in T2DM

1. High fiber diet is known to benefit metabolic health and fiber rich foods are beneficial in T2DM, as they comprise of complex carbohydrates that are resistant to digestion and thereby reduce glucose absorption and insulin secretion (Trivedi et al 1999; Lattimer and Haub 2010).
2. A high intake of DF, mainly of the soluble type above the ADA recommended level, improves blood glucose control, decreases hyperinsulinemia, and lowers plasma lipid concentration (Chandalia et al 2000).
3. Multiple studies have shown that high DF intake helps in significant reduction in the risk of developing diabetes (Lindström et al 2006; Mohan et al 2009; Radhika et al 2009). An inverse relationship has been found between consumption of DF and markers of insulin resistance (Anderson et al 2009; Medicine 2005).
4. In overweight or obese patients with T2DM, a low glycaemic index, high-fiber diet significantly ($p < 0.001$) reduces glucose and insulin area under the curve. The favorable effects on postprandial glucose and insulinemia were sustained through an entire day (Liu et al 2012).
5. Consumption of high fiber, high-carbohydrate, low-GI diets also lessen the risk of increase in serum triglyceride levels (Jung and Choi 2017).
6. In a dietary assessment study in urban Asian Indians with T2DM, low consumption of DF (<29 g/day) was associated with higher prevalence of hypercholesterolemia ($p < 0.01$) and higher LDL. Along with any medication, fiber-rich foods can be used for diabetes to reduce prandial hyperglycaemic deviations, and they may also help in reduction of inter prandial hypoglycemia in

insulin-treated patients. Additionally, studies show that with moderate increase in fiber intake from food or supplements a significant reduction in fasting plasma glucose and insulin levels, and increased insulin sensitivity even in subjects without diabetes can be achieved (Kumar et al 2016).

MNT is an effective approach and an essential component of T2DM prevention and management that comprises counseling and recommendations for dietary intake and nutrition goals by a registered dietitian (RD) or a nutrition expert to optimize metabolic control and maximize treatment. It is a multifaceted process, which encompasses tailoring of diet plans based on the individual's metabolic pathophysiology (prediabetes, early onset T2DM or T2DM with short or long duration) to provide adequate nutrients and calories while accommodating the individual's culinary practices and eating patterns (Viswanathan et al 2019). It is recommended that the diabetic individual should be counselled to take diet which provides high DF (25-40 gm/day) apart from the essential nutrients so as to achieve and maintain a desirable body weight (Chawla et al 2020; Gray and Threlkeld 2012). People who are suffering with T2DM should be guided to choose FDN by increasing their consumption of foods that are rich in fiber, such as high-fiber cereals, vegetables etc., or to use fiber supplements, as may be appropriate nutrition in patients with T2DM (Viswanathan et al 2019). Fiber content from natural food sources. Food sources contain variable amounts of both soluble and insoluble fiber; however, a few sources are seen to contain greater amounts of either one of the fractions.

Limitation:

A “one-size-fits-all” eating plan (with DF in consideration) for the prevention or management of diabetes has not been included. This is due to the wide variations of people affected by diabetes and prediabetes with respect to their cultural background, personal preferences, cooking practices, socioeconomic conditions, and unique gut microbiota profile. Hence, standardization was not achieved.

The focus of this consensus document is to give detailed information about role of high DF in management of T2DM & associated conditions. However, due to lack of enough evidence certain questions remain unanswered. For example: recommendations for DF addition before meal, during meal, immediately after a meal or few hours after meal; alteration of food if DF is added during cooking. We haven't addressed nutrition therapy for children with diabetes or women with gestational diabetes mellitus in this consensus. We recommend that studies be conducted in future for this information.

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