

Medical Nutrition Therapy in Type 1 Diabetes Mellitus

T1 diabetes mellitus (T1DM) is a common and chronic endocrine disorder in young adolescents. It contributes to 5%–10% of total diabetes population.^[1] T1DM is the 2nd most common chronic disease in children in India with an annual incidence of 3 cases/year/1 lakh (IDF 7th edition). With the aim of addressing the relative scarcity of information on youth onset diabetes in India, the Indian Council of Medical Research (ICMR) established “the Registry of People with Diabetes with Young Age at Onset (YDR).” Recent publication from ICMR sponsored multicentric, hospital-based young diabetes registry (onset of diabetes below 25 years) observed more than 80% of young diabetes individuals are suffering from T1DM^[2] (YDR).

T1DM is characterized by absolute insulin deficiency secondary to T-cell-mediated autoimmune destruction of pancreatic β -cells, and these patients have autoantibodies to glutamic acid decarboxylase, insulin autoantigen, insulin which can be detected before clinical diagnosis and their titers decline with time. T1DM typically presents in children but can present much later in life. Bimodal age presentation has been described with a peak around puberty and another peak between 20 and 30 years of age.

Irrespective of etiology of diabetes good glycemic control reduces diabetes-related complications (DCCT and UKPDS). To achieve good glycemic control major arms of management of T1DM are medical nutrition therapy (MNT), exercise, intensive insulin therapy, adjunct oral antidiabetic agents (pioglitazone in T1DM), and self-monitoring of blood glucose. In each treatment, regimen MNT plays pivotal role to achieve target glycemic control (HbA1c <7, preprandial blood glucose of 70–130 mg/dl,^[3] and 2 h postprandial <180 mg/dl).^[3] Design of MNT is determined by multiple factors such as weight, body mass index, physiological state (pregnancy), and associated complication. Nutrition is one of the most important pillars of diabetes management. All patients with T1DM should receive nutrition counseling and be given individualized meal plans based on cultural, regional, traditional and seasonal variations and their socioeconomic status and familial food preferences should be considered while formulating a meal plan. This requires understanding of how different foods affect blood glucose levels, and they should be taught about carbohydrate counting and insulin dose adjustments. Nutrition recommendations^[4] for children and adolescents with T1DM are focused on achieving blood glucose goals without risk of severe hypoglycemia, normal growth and development, and the metabolic parameters within normal limits. Although we have various nutritional guidelines, India specific guidelines and recommendations on dietary prescription is necessary for betterment in the management of T1DM. Especially, it is

very important in India context due to the diversity of India. An Indian study conducted by Kalra *et al.*, published in IJEM 2017 on current indications of nutritional care in children with T1DM in India, has highlighted various dietary prescription practices by health-care practitioners (HCPs) across India in T1DM with the help of questionnaires.^[5]

This study showed a huge diversity in current practice regarding dietary prescriptions. Among the guidelines in the current use, 40% of HCPs used age specific nutrition for children, 35% used ISPAD guidelines, 30% had their own center-specific methods, and 20% used the American Diabetes Association nutritional guidelines^[3] for T2DM. This study showed that regarding preferred methods of prescribing diet, 65% of HCPs mentioned that they provide individualized meal plans and some used printed diet charts (30%), the plate method (20%), and pyramid method (18%) were the methods frequently used. Components of dietary prescription included were calorie content, carbohydrate content, and blood glucose values as major aspects while glycemic index, carbohydrate type (simple vs. complex), and fiber content as minor aspects. A majority of HCPs considered dietary adjustments in meal plan is the best method, so as to allow to have food of choice by the child with T1DM. For this, they used food exchange method as the most preferred method of diet adjustment.^[5] This study also showed that parent education and family support to the child and repeated diet prescriptions play an important role in ensuring diet adherence.

Salient points to be concerned in proposed guidelines as per respondents include:^[5]

- Carbohydrate content of various Indian food preparations
- Mix and match techniques (with quantity described) to make every food healthy, for example, dal chawal, potato fingers, and sprouts counseling techniques for both child and parents
- Recipes of low-calorie desserts recipes based on regional cuisine
- Age-specific guidelines
- Notes for diet in various situations such as school, festivals, and birthday parties.

Patients with T1DM have a high risk of developing other autoimmune disorders such as Hashimoto’s thyroiditis, Addison’s disease, celiac disease (CD), pernicious anemia the association is due to a common genetic and immunological background as both the diseases are associated with the major histocompatibility complex class II antigen DQ2 encoded by the alleles, DQA1*501 and DQB1*201 and HLADR3/DQ2.^[6-8] The estimated prevalence of CD in T1DM is 0.6%–16.4%^[8-10] and it affects at least 10% of patients with type 1 diabetes at some point in their lives. All patients with T1DM CD do not

have gastrointestinal symptoms. Therefore, children diagnosed with T1DM should undergo routine screening for CD and are tested for autoantibody (anti-Ttg immunoglobulin) at the onset of DM and then annually during follow-up but it is debated his timing and frequency of screening. Sole treatment of CD is gluten free diet (GFD).^[10] If antibodies are present, it is mandatory to perform esophagogastroduodenoscopy with bowel biopsy to confirm the diagnosis.^[6] The presence of mucosal atrophy is an indication to start GFD, which forms a standard therapy for CD. Strict compliance to GFD is essential to prevent acute (malabsorption, Failure to thrive (FTT)) and chronic (intestinal lymphoma, infertility, and osteoporosis) complications. GFD added to diabetic dietary regimen imposes practical limitations and leads to lifestyle restriction in children, leading to noncompliance to GFD. A study by Valerio *et al.*^[11] found that only 59% of patients with T1DM and CD were compliant to strict GFD while 78% with the only CD was complaint to GFD. Moreover, combining GFD in T1DM children is challenging as it is of high glycemic index in contrast to diabetic diet should have low glycemic index. This will influence the glycemic control, glycemic variability, insulin dosage, lipid profiles, and other long-term complications. Moreover, GFD could modify anthropometric parameters such as height, weight, body mass index (BMI), and growth velocity. Effect of GFD on T1DM by Abid *et al.*^[12] documented GFD showed benefits by decreasing the episodes of severe hypoglycemia while no changes in standard deviation score for BMI, HbA1C with GFD mean insulin requirement.

In recent years, the use of adjunctive therapies to insulin—those that improve glucose metabolism and reduce insulin side effects—have become a popular topic of interest. A number of oral anti-diabetic agents have been tested in clinical trials as insulin adjuncts for management of T1DM, including thiazolidinediones,^[13] biguanides,^[14] glucagon-like peptide 1 analogs,^[15] alpha glucosidase inhibitors, dipeptidyl peptidase-4 (DPP-4) inhibitors,^[16] and sodium glucose co-transport-2 (SGLT-2) inhibitors.^[17] Currently, pramlintide, a peptide hormone analog, is the only insulin adjunct that is approved by the U. S. Food and Drug Administration for T1DM.^[17] The effect of SGLT-2 inhibitors, with a unique mechanism of insulin-independent glucose disposal, represents a promising new therapy for T1DM. The available studies suggest that SGLT-2 inhibitors are an effective and safe insulin adjunct therapy, improving glycemic control, reducing body weight, and metabolic parameters such as blood pressure and plasma lipid profile. Taken together, the aforementioned suggests a potential benefit of cardiovascular and kidney protection, and the use of SGLT-2 inhibitors may play an important role in decreasing T1DM complications.^[17] However, the patients should be emphasized to be compliant with insulin therapy and should be educated to match their food intake and exercise according to insulin schedule and regimen.

Individuals with T1DM and CD needs special dietary plans, and high index of suspicion and routine screening of CD in T1DM individuals helps in prevention of CD-related

complications.^[18,19] India is a country of diversity and needs India specific guide lines for our population for T1DM.

K. Sandhya Rani, Sanjay Kumar Bhadada¹

Department of Endocrinology, NMCH, Nellore, Andhra Pradesh, ¹Department of Endocrinology, PGIMER, Chandigarh, India

Address for correspondence: Prof. Sanjay Kumar Bhadada, Department of Endocrinology, Room No.2, 4th Floor Block-F, Nehru Hospital, PGIMER Chandigarh, India.
E-mail: bhadadask@rediffmail.com


REFERENCES

1. Raha O, Chowdhury S, Dasgupta S, Raychaudhuri P, Sarkar BN, Raju PV, *et al.* Approaches in type 1 diabetes research: A status report. *Int J Diabetes Dev Ctries* 2009;29:85-101.
2. Praveen PA, Madhu SV, Mohan V, Das S, Kakati S, Shah N, *et al.* Registry of youth onset diabetes in India (YDR): Rationale, recruitment, and current status. *J Diabetes Sci Technol* 2016;10:1034-41.
3. American Diabetes Association. Treatment goals recommendation 2015 (position statement). *Diabetes Care* 2017;40:S48-56.
4. Silverstein J, Klingensmith G, Copeland K, Plotnick L, Kaufman F, Laffel L, *et al.* Care of children and adolescents with type 1 diabetes: A Statement of the American Diabetes Association. *Diabetes Care* 2005;28:186-212.
5. Kalra S, Das AK, Raghupathy P, Chowdhury S, Saboo BD, Dinakaran P, *et al.* Current Indicators of Nutritional Care in Children with Type 1 Diabetes in India: Do we Need a National Nutritional Guideline? 2017.
6. Husby S, Koletzko S, Korponay-Szabó IR, Mearin ML, Phillips A, Shamir R, *et al.* European Society for Pediatric Gastroenterology, Hepatology, and Nutrition guidelines for the diagnosis of coeliac disease. *J Pediatr Gastroenterol Nutr* 2012;54:136-60.
7. Barker JM. Clinical review: Type 1 diabetes-associated autoimmunity: Natural history, genetic associations, and screening. *J Clin Endocrinol Metab* 2006;91:1210-7.
8. Bhadada SK, Kochhar R, Bhansali A, Dutta U, Kumar PR, Poornachandra KS, *et al.* Prevalence and clinical profile of coeliac disease in type 1 diabetes mellitus in North India. *J Gastroenterol Hepatol* 2011;26:378-81.
9. Rewers M, Eisenbarth GS. Autoimmunity: Celiac disease in T1DM—the need to look long term. *Nat Rev Endocrinol* 2011;8:7-8.
10. Marchese A, Lovati E, Biagi F, Corazza GR. Coeliac disease and type 1 diabetes mellitus: Epidemiology, clinical implications and effects of gluten-free diet. *Endocrine* 2013;43:1-2.
11. Valerio G, Maiuri L, Troncone R, Buono P, Lombardi F, Palmieri R, *et al.* Severe clinical onset of diabetes and increased prevalence of other autoimmune diseases in children with coeliac disease diagnosed before diabetes mellitus. *Diabetologia* 2002;45:1719-22.
12. Abid N, McGlone O, Cardwell C, McCallion W, Carson D. Clinical and metabolic effects of gluten free diet in children with type 1 diabetes and coeliac disease. *Pediatr Diabetes* 2011;12:322-5.
13. Bhat R, Bhansali A, Bhadada S, Sialy R. Effect of pioglitazone therapy in lean type 1 diabetes mellitus. *Diabetes Res Clin Pract* 2007;78:349-54.
14. Liu C, Wu D, Zheng X, Li P, Li L. Efficacy and safety of metformin for patients with type 1 diabetes mellitus: A meta-analysis. *Diabetes Technol Ther* 2015;17:142-8.
15. Kuhadiya ND, Malik R, Bellini NJ, Patterson JL, Traina A, Makdissi A, *et al.* Liraglutide as additional treatment to insulin in obese patients with type 1 diabetes mellitus. *Endocr Pract* 2013;19:963-7.
16. Garg SK, Moser EG, Bode BW, Klaff LJ, Hiatt WR, Beatson C, *et al.* Effect of sitagliptin on post-prandial glucagon and GLP-1 levels in patients with type 1 diabetes: Investigator-initiated, double-blind, randomized, placebo-controlled trial. *Endocr Pract* 2013;19:19-28.
17. Miller KM, Foster NC, Beck RW, Bergenstal RM, DuBose SN, DiMeglio LA, *et al.* Current state of type 1 diabetes treatment in the U.S.: Updated data from the T1D exchange clinic registry. *Diabetes Care* 2015;38:971-8.
18. Bhadada SK, Rastogi A, Agarwal A, Kochhar R, Kochhar R,

Bhansali A, *et al.* Comparative study of clinical features of patients with celiac disease & those with concurrent celiac disease & type 1 diabetes mellitus. *Indian J Med Res* 2017;145:334-8.

19. Bhadada SK, Bhansali A, Kochhar R, Menon AS, Sinha SK, Dutta P, *et al.* Does every short stature child need screening for celiac disease? *J Gastroenterol Hepatol* 2008;23:e353-6.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

Access this article online	
Quick Response Code: 	Website: www.ijem.in
	DOI: 10.4103/ijem.IJEM_539_17

How to cite this article: Rani KS, Bhadada SK. Medical nutrition therapy in type 1 diabetes mellitus. *Indian J Endocr Metab* 2017;21:649-51.