

T1DM: Guideline Recommendations and Supporting Documentation (2024)

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Guideline recommendations are the essence of evidence-based guidelines and provide a course of action for the practitioner based on the evidence. Below, you will find the Type 1 Diabetes Mellitus Pediatrics (2024) recommendations organized by Nutrition Care Process category.

Each recommendation receives a rating, of Strong, Weak, or Consensus. The rating for the recommendation is primarily based on the strength of the supporting evidence but also the balance between benefits or harms anticipated and the clinical practice implications. Recommendation statements include the terms "recommend/should" for strong recommendations, "suggest/may" for weak recommendations, and "it is reasonable" for consensus recommendations. The Academy categorizes recommendations in terms of either Imperative or Conditional statements. Conditional statements clearly define a specific situation or specific subpopulation with the larger guideline population. Imperative statements are broadly applicable to the target population without restraints on their application. [Learn more](#)

Resources Available with Each Recommendation

In addition to the recommendation statement and strength rating, on each recommendation page, you will find:

- A brief narrative summary of the evidence analyzed to reach the recommendation
- A statement of justification, or reason for the strength of the recommendation
- Detailed information on the evidence supporting the recommendations and background narrative (available in the Supporting Evidence section toward the bottom of each recommendation page)
- A reference list at the end of each recommendation page that includes all the sources used in the evidence analysis for the particular recommendation (each reference is hyperlinked to a summary of the article analyzed in the evidence analysis).

Screening

- [Nutrition Screening](#)

Assessment

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Intervention

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- [Macronutrient Composition](#)
- [Dietary Patterns](#)
- [Vitamin D](#)
- [Culturally Relevant/Responsive Nutrition](#)
- [Food Insecurity](#)

Monitoring and Evaluation

- [Medical Nutrition Therapy](#)

Proceed to Benefits and Risks/Harms of Implementation

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- [Diabetes: Type 1 \(Pediatrics\)](#)
- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Nutrition Screening (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Vitamin D Deficiency Screening

In children and adolescents, we suggest screening for vitamin D deficiency at stage I type 1 diabetes (≥ 2 type 1 diabetes associated islet autoantibodies) or first onset of type 1 diabetes symptoms.

Rating: Consensus
Conditional

T1DM: Screening for Associated Factors

It is reasonable that health care professionals screen for disordered eating behaviors, food insecurity, housing stability/homelessness, health literacy, financial barriers, and social/community support and apply that information to treatment decisions.

Rating: Consensus
Conditional

- [Risks/Harms of Implementing This Recommendation](#)

No harms associated with the implementation of this recommendation. No obvious harms or risks associated with screening individuals for risk of eating disorders, vitamin D status or food insecurity issues. No significant cost may be associated with implementing this recommendation. Two recognized costs are the time and expense that may be required to train RDNs to perform the screening. However, most of the training materials are available in print or online and dietitians are typically familiar with these resources, or they are readily discoverable.

- [Conditions of Application](#)

Providers can follow guidance of their workplace on conducting the screening.

- [Potential Costs Associated with Application](#)

Time and cost may be necessary to train RDNs to conduct this screening. Additional costs will vary according to insurance coverage.

- [Recommendation Narrative](#)

Evidence also indicates that vitamin D deficiency is prevalent among all youth in the U.S., including those with T1DM. In children and adolescents (6-19 years old) living with T1DM, vitamin D insufficiency (defined as serum 25-hydroxyvitamin D [25(OH)D] concentrations of 30 - 50 nmol/L or 12 - 20 ng/mL) and/or deficiency (defined as serum 25-hydroxyvitamin D [25(OH)D] concentrations of <30 nmol/L or <12 ng/mL) are common, affecting as many as 63% of patients. Vitamin D supplementation repletes vitamin deficiency but given the notably suboptimal glycemic management among children and adolescents with T1DM, understanding the role of vitamin D supplementation on A1C is imperative. Recent evidence states that vitamin D can protect pancreatic beta cells and hence might help with achieving glycemic targets. Hence, screening individuals with T1DM for vitamin D status can be helpful.

- [Recommendation Strength Rationale](#)

This recommendation is based on expert panel's Consensus.

- [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of vitamin D supplementation compared to no supplementation on A1C?](#)

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the association between food insecurity / socioeconomic status and glycemic outcomes and adverse events?](#)

- [References](#)

lovane B, Cangelosi A, Bonaccini I, Mastroianni C, Di Mauro D, Fainardi V, Chiari G, Maltese M, Caffarelli C, Vanelli M. Effectiveness of a tailored medical support to overcome the barriers to education, treatment and good metabolic control in children with type-1 diabetes from ethnic minorities. *Acta Bio-Medica : Atenei Parmensis* 2018; 88:477-482

Pascual A, Pyle L, Nieto J, Klingensmith G, Gonzalez A. Novel, culturally sensitive, shared medical appointment model for Hispanic pediatric type 1 diabetes patients. *Pediatric Diabetes* 2019; 20:468-473

Giri D, Pintus D, Burnside G, Ghatak A, Mehta F, Paul P, Senniappan S. Treating vitamin D deficiency in children with type 1 diabetes could improve their glycaemic control.. *BMC Research Notes* 2017; 10:465

Nafei L, Ali Kadhim K, Muaffaq Said A, Hameed Ghani S.. Evaluation the Effect of Vitamin D3 on Glycemic Indices on Iraqi Children with Type 1 DM. *International Journal of Pharmaceutical Sciences Review and Research* 2017; 42:134-143

Panjiyar R, Dayal D, Attri S, Sachdeva N, Sharma R, Bhalla A. Sustained serum 25-hydroxyvitamin D concentrations for one year with cholecalciferol supplementation improves glycaemic control and slows the decline of residual beta cell function in children with type 1 diabetes. *Pediatric Endocrinology, Diabetes, and Metabolism* 2018; 2018:111-117

Sharma S, Biswal N, Bethou A, Rajappa M, Kumar S, Vinayagam V. Does Vitamin D Supplementation Improve Glycaemic Control In Children With Type 1 Diabetes Mellitus? - A Randomized Controlled Trial. *Journal of Clinical and Diagnostic Research* 2017; 11:SC15-SC17

Shih E, Mittelman S, Pitukcheewanont P, Azen C, Monzavi R. Effects of vitamin D repletion on glycemic control and inflammatory cytokines in adolescents with type 1 diabetes. *Pediatric Diabetes* 2014; 17:36-43

Treiber G, Prietl B, Fröhlich-Reiterer E, Lechner E, Ribitsch A, Fritsch M, Rami-Merhar B, Steigleder-Schweiger C, Graninger W, Borkenstein M, Pieber T. Cholecalciferol supplementation improves suppressive capacity of regulatory T-cells in young patients with new-onset type 1 diabetes mellitus - A randomized clinical trial. *Clinical Immunology (Orlando, Fla.)* 2015; 161:217-224

- o [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

- Kumar J, Muntner P, Kaskel FJ, Hailpern SM, Melamed ML. Prevalence and associations of 25-hydroxyvitamin D deficiency in US children: NHANES 2001-2004. *Pediatrics*. 2009;124(3):e362-370. PMID: 19661054 doi: [10.1542/peds.2009-0051](#). Epub 2009 Aug 3.

- [Diabetes: Type 1 \(Pediatrics\)](#)
- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Nutrition Assessment (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Nutrition Assessment

In children and adolescents newly diagnosed with type 1 diabetes, it is reasonable for a registered dietitian nutritionist or international equivalent to complete a thorough nutrition and diabetes education assessment that also considers:

- o Review and assess data from regular screenings for glycemic labs, lipid abnormalities, blood pressure, and celiac disease per American Diabetes Association Standards of Care.
- o Current type 1 diabetes knowledge, skills, competency of required diabetes management.
- o Readiness to change of child/adolescents and their care partners.
- o Barriers to learning.
- o Access to diabetes management tools/resources and medications.
- o Psychosocial needs/barriers, including social support, financial resources.
- o Disordered eating behaviors.
- o Client/family input on glycemic targets.

Rating: Consensus

Imperative

Rating: Consensus

Imperative

- o [Risks/Harms of Implementing This Recommendation](#)

No obvious harms or risks associated with screening or assessment of individuals for risk of eating disorders, vitamin D status or food insecurity issues. No significant cost may be associated with implementing this recommendation. Two recognized costs are the time and expense that may be required to train RDs to perform the screening. However, most of the training materials are available in print or online and RDs are typically familiar with these resources, or they are readily discoverable.

- [Conditions of Application](#)

Significant changes in disease treatment plans warrant full nutrition assessment and newly diagnosed individuals will have different needs compared to follow-up visits. There is the potential that individuals and families with lower socio-economic status will have more difficulty paying for additional expenses that they might incur while managing their children's condition. In these cases, practitioners may offer low-cost options to help them manage their needs.

- [Potential Costs Associated with Application](#)

No significant cost may be associated with implementing this recommendation. Two recognized costs are the time and expense that may be required to train RDNs to perform the screening. However, most of the training materials are available in print or online and RDNs are typically familiar with these resources, or they are readily discoverable.

- [Recommendation Narrative](#)

Evidence indicates that periodically evaluating growth, anthropometric parameters, and assessing the nutritional status should be considered during regular follow-up visits of children and adolescents living with T1DM (Grabia 2021, Hill-Briggs 2020). Managing diabetes during childhood and adolescence places a burden on the youth and family, and hence the RDN should conduct ongoing assessments of psychosocial status, social determinants of health, and diabetes distress in the youth and the parents/caregivers during routine diabetes visits (Hill-Briggs 2020, Hagger 2016).

- [Recommendation Strength Rationale](#)

This recommendation is based on consensus of expert panel members.

- [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of medical nutrition therapy provided by registered dietitian nutritionists compared to no standard care on A1C?](#)

- [References](#)

[Bakir E, Çavusoglu H, Mengen E. Effects of the Information-Motivation-Behavioral Skills Model on Metabolic Control of Adolescents with Type 1 Diabetes in Turkey: Randomized Controlled Study. *Journal of Pediatric Nursing* 2021; 58:e19-e27](#)

[Dluzniak-Golaska K, Panczyk M, Szypowska A, Sinska B, Szostak-Wegierek D. Influence of two different methods of nutrition education on the quality of life in children and adolescents with type 1 diabetes mellitus - a randomized study. *Roczniki Panstwowego Zakladu Higieny* 2020; 71:197-206](#)

[Donzeau A, Bonnemaïson E, Vautier V, Menut V, Houdon L, Bendelac N, Bismuth E, Bouhours-Nouet N, Quemener E, Baron S, Nicolino M, Faure N, Pochelu S, Barat P, Coutant R. Effects of advanced carbohydrate counting on glucose control and quality of life in children with type 1 diabetes. *Pediatric Diabetes* 2020; 21:1240-1248](#)

[Kostopoulou E, Livada I, Partsalaki I, Lamari F, Skiadopoulos S, Rojas Gil A, Spiliotis B. The role of carbohydrate counting in glycemic control and oxidative stress in patients with type 1 diabetes mellitus \(T1DM\). *Hormones \(Athens, Greece\)* 2020; 19:433-438](#)

[Majumdar I, Bethin K, Quattrin T. Weight trajectory of youth with new-onset type 1 diabetes comparing standard and enhanced dietary education. *Endocrine* 2014; 49:155-162](#)

[Spiegel G, Bortsov A, Bishop F, Owen D, Klingensmith G, Mayer-Davis E, Maahs D. Randomized nutrition education intervention to improve carbohydrate counting in adolescents with type 1 diabetes study: is more intensive education needed?. *Journal of the Academy of Nutrition and Dietetics* 2012; 112:1736-1746](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

- Grabia M, Markiewicz-Zukowska R. Nutritional Status of Pediatric Patients with Type 1 Diabetes Mellitus from Northeast Poland: A Case-Control Study. *Diabetes Ther.* 2021 Jan;12(1):329-343. PMID: 33289859 doi: [10.1007/s13300-020-00972-1](#), Epub 2020 Dec 8.
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- [Diabetes: Type 1 \(Pediatrics\)](#)

- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Medical Nutrition Therapy Intervention (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Medical Nutrition Therapy

Medical nutrition therapy provided by a registered dietitian nutritionist or international equivalent is recommended for children and adolescents living with type 1 diabetes to manage A1C, as appropriate and desired by each client.

Rating: Level 1(C)

Imperative

T1DM: Medical Nutrition Therapy-Initial Encounters

In children and adolescents living with type 1 diabetes, it is reasonable for a registered dietitian nutritionist or an international equivalent to collaborate with individuals with type 1 diabetes, their families, and interdisciplinary healthcare teams to design individualized medical nutrition therapy based upon the individual's diabetes treatment plan, overall health and nutritional status, personal preferences, psychological and psychosocial factors, and physiological needs. Medical nutrition therapy for individuals with type 1 diabetes should focus on comprehensive nutrition assessment that includes considerations for insulin planning/administration, reducing short-term adverse events (hyperglycemia, hypoglycemia) and appropriate interventions, including individualized modification of diet, to maintain or improve nutrition status, and monitoring over time.

Rating: Consensus

Imperative

Rating: Consensus

Imperative

- [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by RDNs for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select or the individuals with diabetes cannot implement the appropriate carbohydrate management strategy. Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc., and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Conditions of Application](#)

Barriers to Implementing

Access to RDN services may be limited by the number of professionals, the availability of these individuals and physical access to schedule. Families may experience burden due to the volume of appointments they are required to attend, despite the need/desire for the information provided by the service (and the support). Appointments may mean missing school (children/adolescents) and work (parents/caregivers) and lost wages. Also, increased travel costs, and childcare costs can be barriers to accessing care. Telehealth options can mitigate some of these issues.

Recommendations focusing on dietary patterns, diet quality, and making appropriate changes in dietary intake without addressing food insecurity may inadvertently have potential risks and harms in some populations as implementation of this recommendation may not be accessible to underserved and vulnerable populations. Underserved and vulnerable populations are populations that face health, financial, educational, and/or housing disparities ([Serving Vulnerable and Underserved Populations](#). Accessed January 17, 2023). Access to supermarkets and convenience stores that have a variety of foods is known to be limited in neighborhoods with high minority populations and low population density, which could limit access to lower, healthier food choices (Larson 2009). Underserved and vulnerable populations with limited health literacy may not have access to nutrition education and resources that would facilitate making this change. Food insecurity may also serve as a potential barrier to following this guideline, as provision of adequate food and nutrients may take priority.

Acceptability

There is limited research on the acceptability of MNT provided by RDNs among children and adolescents with T1DM. However, this limited evidence indicates that children and adolescents living with T1DM understand that food plays a central role in the management of diabetes (Ye 2017). Stakeholders for these recommendations included children and adolescents with diabetes, families, caregivers, RDNs, health professionals, educators, and support services. Findings from Ye 2017 mention that teens are not only concerned about outcomes like management of their blood glucose, but also their interactions with peers, and emotional well-being, to name a few. Based on the results from these articles, it is clear that children and adolescents living with T1DM and their parents/caregivers do value MNT from RDNs and understand that dietary knowledge and behavior are important for management of their blood glucose. Chalmers 2022 indicated that developing social media related tools or education materials to discuss T1DM might be helpful. Overall, evidence indicates that stakeholders desired a personalized approach, not just focusing on A1C management but also other outcomes like emotional and physical well-being, access to dietetic services, and a shared decision-making relationship with the RDN.

Implementation Considerations

RDNs should work within interdisciplinary teams to promote the implementation of nutrition care. Interdisciplinary team protocols should include nutrition screening and referral to RDNs for individualized MNT. Incorporation of nutrition screening and referral to RDNs requires coordination of administrators, and organizational policies and procedures. Issues like feasibility of implementation, values of interventions, and equity issues should be considered while developing care plans for clients.

The primary goal of implementing these recommendations is improving client outcomes while individualizing care to your client's preferences and health status. Although the costs of MNT sessions and reimbursement vary, MNT is significantly associated with improved client outcomes. MNT can be considered cost-effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities versus the cost of the interventions. The dietary recommendation can be implemented in numerous ways and hence is easy to incorporate into practice. This recommendation can be incorporated into ongoing counseling sessions and does not require any extra resources. However, there can be some barriers to providing care and the RDN should consider these when planning interventions for their clients. Issues like lack of insurance or higher out-of-pocket costs are more likely to impact the ability of certain demographics/groups to obtain care. Diabetes complications, both short and long-term, could be more frequent for those who have access problems, costing more for the individual, family, and the health-care system as a whole. Limited services by RDNs in some areas (eg, rural) can also be a barrier.

The RDN should work with both children and adolescents with T1DM and their parents/caregivers, as they play a critical part in self-management in youth. The treatment plan should focus on normal growth and development of the individual along with dietary management. The RDN should screen and assess the educational, psychological, emotional, behavioral, and access to food status of children and work with parents/caregivers to help implement the treatment plan.

RDNs can play a central role in helping individuals obtain the skills needed to balance dietary intake, quality of life, and glycemic goals. Potential skills to assist with:

- Identifying and quantifying carbohydrate foods.
- Understanding average carbohydrate intake for age, weight, activity level.
- Calculating insulin dosages based on carbohydrate intake from foods and beverages.
- Quantifying carbohydrate quantities in foods when dining away from home.
- Choosing foods on a limited budget.
- Choosing foods to promote a healthy growth pattern.
- Defining healthy eating attitudes and behaviors to reduce the risk of disordered or dysfunctional eating.
- Managing hypoglycemia.
- Understanding nutrition guidelines for sick days.
- Understanding nutrition recommendations for religious/ethnic considerations (eg, fasting, foods avoided, etc.).
- Navigating eating and glycemic management while traveling.
- Understanding nutrition recommendations for exercise and physical activity to optimize glycemic goals, prevent hypoglycemia, and optimize performance through nutrition.
- For those interested in technology, introducing the use of apps to assist with tasks related to identifying and quantifying carbohydrate foods, tracking food intake, understanding the impact on different variables, including food, on blood glucose.
- Understanding the use of continuous glucose monitoring, insulin smart pen, and/or insulin pump data as diabetes self-management tools to aid in optimal post-prandial glycemia, management of hypoglycemia, and sports performance.

Additional information to consider when determining the best methods of implementing recommendations:

- Consider client's age, socio-economic status, cultural membership, psychological and mental health status, health history, and other individual and health conditions.
- Dietary pattern-focused interventions may have small to moderate benefits for individuals with diabetes and little to no harm. Benefits would include changes in diet that show an improvement in A1C and quality of life. Secondary benefits could be seen with improvements in lipid profiles, blood pressure, and optimizing of BMI through growth and development.
- Changes in diet quality or intake may result in hypoglycemia. Thus, practitioners must ensure families know how to treat low blood glucose and discuss insulin adjustments should there be a pattern of hypoglycemia. Insulin adjustments should always be considered before suggesting it.
- While providing counseling and care for individuals regarding dietary interventions, evaluate for signs of disordered eating.
- At present there are no guidelines for best practice recommendations on vitamin D supplementation. Practitioners should use their own clinical expertise and individualize based on patients' needs.
- Consider all types of learning in teaching methods, including visual, kinesthetic, audible, and written, and include demonstrations and teaching back skills when appropriate.
- The Academy has developed [Implementing Evidence: from Guidelines to Daily Practice](#), a new resource which aims to assist nutrition and dietetics practitioners with implementing evidence-based practice recommendations and clinical practice innovations into daily practice.

RDNs are encouraged to incorporate *inclusion, diversity, equity, and access (IDEA)* in their practice when working with individuals living with T1DM. Addressing health inequities extends beyond providing individualized advice that considers social determinants of health and other barriers to healthy lifestyle behaviors. The Academy's member website, eatrightPRO.org, includes a section titled "IDEA Hub" that provides resources for RDNs aiming to advance IDEA principles in their practices and professions. For example, providing dietary counseling on diet quality would probably create more equity, as some cultures do not value fruit, vegetables, and high fiber in the diet. Providing this education could help to improve overall health for all populations, thus improving health equity.

- o [Potential Costs Associated with Application](#)

Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create a moderate saving.

- [Recommendation Narrative](#)

Five randomized controlled trials (RCTs) (Bakir et al. 2021, Dlugniak et al. 2020 and 2019, Donzeau et al. 2020, Majumdar et al. 2015, Spiegel et al. 2012) and one non-randomized trial (Kostopoulou et al. 2020) reported on the effectiveness of MNT provided by an RDN. Majority of the studies included participants who had diabetes for more than one year before study entry (Dlugniak 2020 and 2019, Donzeau 2020, Kostopoulou 2020, Spiegel 2012). One study included newly diagnosed children and adolescents with T1DM (Majumdar 2015) and one (Bakir 2021) included participants with a T1DM diagnosis established at least six months ago. Duration of intervention in these studies ranged from 3.25 months to 12 months. The number of contacts between these studies varied; Bakir had thirteen contacts over the intervention period, Kostopoulou had nine contacts, Majumdar had six contacts, Donzeau had five contacts, and Dlugniak had four contacts. Five RCTs demonstrated low risk of bias (Bakir 2021, Dlugniak 2020 and 2019, Donzeau 2020, Majumdar 2015, Spiegel 2012), and one non-randomized controlled trial demonstrated moderate risk of bias (Kostopoulou 2020).

These studies examined the effectiveness of MNT on A1C. All studies included RDNs as a provider of MNT for the intervention group and the comparator group received standard care. Not all six studies could be included in the pooled analysis due to data reporting issues. Three studies (Bakir 2021, Donzeau 2020, Kostopoulou 2020) reported a significant reduction in A1C at the end of the intervention. Three other studies (Dlugniak 2020 and 2019, Majumdar 2015, Spiegel 2012) reported a reduction in A1C at the end of intervention. However, the A1C difference between the intervention group and the control group was not statistically significant. Pooled analysis of three studies (Bakir 2021, Dlugniak 2020 and 2019, Spiegel 2012) indicated that MNT intervention did reduce HbA1c levels, however the findings were not statistically significant [MD (95% CI):-0.323% (-0.708, 0.062); I=73.63%] and heterogeneity was moderate. However, the certainty of evidence was low.

In children and adolescents with T1DM, low quality evidence reported that weekly MNT sessions for the first month after diagnosis and monthly sessions thereafter achieved significant reductions in A1C. For those receiving less frequent encounters with RDNs, evidence reports mixed findings on the effectiveness of MNT.

- [Recommendation Strength Rationale](#)

The recommendation was based on LOW level evidence from examining the efficacy of medical nutrition therapy interventions.

- [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of medical nutrition therapy provided by registered dietitian nutritionists compared to no standard care on A1C?](#)

- [References](#)

[Bakir E, Çavusoglu H, Mengen E. Effects of the Information-Motivation-Behavioral Skills Model on Metabolic Control of Adolescents with Type 1 Diabetes in Turkey: Randomized Controlled Study. *Journal of Pediatric Nursing* 2021; 58:e19-e27](#)

[Dlugniak-Golaska K, Panczyk M, Szypowska A, Sinska B, Szostak-Wegierek D. Influence of two different methods of nutrition education on the quality of life in children and adolescents with type 1 diabetes mellitus - a randomized study. *Roczniki Panstwowego Zakladu Higieny* 2020; 71:197-206](#)

[Donzeau A, Bonnemaïson E, Vautier V, Menut V, Houdon L, Bendelac N, Bismuth E, Bouhours-Nouet N, Quemener E, Baron S, Nicolino M, Faure N, Pochelu S, Barat P, Coutant R. Effects of advanced carbohydrate counting on glucose control and quality of life in children with type 1 diabetes. *Pediatric Diabetes* 2020; 21:1240-1248](#)

[Kostopoulou E, Livada I, Partsalaki I, Lamari F, Skiadopoulos S, Rojas Gil A, Spiliotis B. The role of carbohydrate counting in glycemic control and oxidative stress in patients with type 1 diabetes mellitus \(T1DM\). *Hormones \(Athens, Greece\)* 2020; 19:433-438](#)

[Majumdar I, Bethin K, Quattrin T. Weight trajectory of youth with new-onset type 1 diabetes comparing standard and enhanced dietary education. *Endocrine* 2014; 49:155-162](#)

[Spiegel G, Bortsov A, Bishop F, Owen D, Klingensmith G, Mayer-Davis E, Maahs D. Randomized nutrition education intervention to improve carbohydrate counting in adolescents with type 1 diabetes study: is more intensive education needed?. *Journal of the Academy of Nutrition and Dietetics* 2012; 112:1736-1746](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

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- [Diabetes: Type 1 \(Pediatrics\)](#)
- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Diet Quality (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

• [Recommendation\(s\)](#)

T1DM: Diet Quality

In children and adolescents living with type 1 diabetes, we suggest having a registered dietitian nutritionist or an international equivalent provide individualized nutrition education that includes discussion on diet quality to manage glycemia.

Rating: Level 2(D)

Conditional

○ [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by RDNs for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select, or if the individuals with diabetes cannot implement, the appropriate carbohydrate management strategy. Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression.

Access to RDN services may be limited by the number of professionals, the availability of these individuals and physical access to schedule. Families may experience burden due to the volume of appointments they are required to attend, despite the need/desire for the information provided by the service (and the support). Appointments may mean missing school (children/adolescents) and work (parents/caregivers) and lost wages. Also, increased travel costs, and childcare costs can be barriers to accessing care. Telehealth options can mitigate some of these issues.

Recommendations focusing on dietary patterns, diet quality, and making appropriate changes in dietary intake without addressing food insecurity may inadvertently have potential risks and harms in some populations as implementation of this recommendation may not be accessible to underserved and vulnerable populations. Underserved and vulnerable populations are populations that face health, financial, educational, and/or housing disparities ([Serving Vulnerable and Underserved Populations](#). Accessed January 17, 2023). Access to supermarkets and convenience stores that have a variety of foods is known to be limited in neighborhoods with high minority populations and low population density, which could limit access to lower, healthier food choices (Larson 2009). Underserved and vulnerable populations with limited health literacy may not have access to nutrition education and resources that would facilitate making this change. Food insecurity may also serve as a potential barrier to following this guideline, as provision of adequate food and nutrients may take priority.

○ [Conditions of Application](#)

RDNs should work within interdisciplinary teams to promote the implementation of nutrition care. Interdisciplinary team protocols should include nutrition screening and referral to RDNs for individualized MNT. Incorporation of nutrition screening and referral to an RDN requires coordination of administrators, and organizational policies and procedures. Issues like feasibility of implementation, values of interventions, and equity issues should be considered while developing care plans for clients.

The primary goal of implementing these recommendations is improving client outcomes while individualizing care to your client's preferences and health status. Although the costs of MNT sessions and reimbursement vary, MNT is significantly associated with improved client outcomes. MNT can be considered cost-effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities versus the cost of the interventions. The dietary recommendation can be implemented in numerous ways and hence is easy to incorporate into practice. This recommendation can be incorporated into ongoing counseling sessions and does not require any extra resources. However, there can be some barriers to providing care and RDNs should consider these when planning interventions for their clients. Issues like lack of insurance or higher out-of-pocket costs are more likely to impact the ability of certain demographics/groups to obtain care. Diabetes complications, both short and long-term, could be more frequent for those who have access problems, costing more for the individual, family, and the health-care system as a whole. Limited services by RDNs in some areas (eg. rural) can also be a barrier.

The RDN should work with both children and adolescents with T1DM and their parents/caregivers, as they play a critical part in self-management in youth. The treatment plan should focus on normal growth and development of the individual along with dietary management.

RDNs should screen and assess the educational, psychological, emotional, behavioral, and access to food status of children and work with parents/caregivers to help implement the treatment plan.

RDNs can play a central role in helping individuals obtain the skills needed to balance dietary intake, quality of life, and glycemic goals. Potential skills to assist with:

- Identifying and quantifying carbohydrate foods.
- Understanding average carbohydrate intake for age, weight, activity level.
- Calculating insulin dosages based on carbohydrate intake from foods and beverages.
- Quantifying carbohydrate quantities in foods when dining away from home.
- Choosing foods on a limited budget.
- Choosing foods to promote a healthy growth pattern.
- Defining healthy eating attitudes and behaviors to reduce the risk of disordered or dysfunctional eating.
- Managing hypoglycemia.
- Understanding nutrition guidelines for sick days.
- Understanding nutrition recommendations for religious/ethnic considerations (eg, fasting, foods avoided, etc.).
- Navigating eating and glycemic management while traveling.
- Understanding nutrition recommendations for exercise and physical activity to optimize glycemic goals, prevent hypoglycemia, and optimize performance through nutrition.
- For those interested in technology, introducing the use of apps to assist with tasks related to identifying & quantifying carbohydrate foods, tracking food intake, understanding the impact on different variables, including food, on blood glucose.
- Understanding the use of continuous glucose monitoring, insulin smart pen, and/or insulin pump data as diabetes self-management tools to aid in optimal post-prandial glycemia, management of hypoglycemia, and sports performance.

o [Potential Costs Associated with Application](#)

The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

o [Recommendation Narrative](#)

Two cohort studies regarding diet quality in pediatric T1DM reported on glycemic outcomes and/or anthropometrics (Liese 2020; Nansel 2016). In one prospective cohort study (Liese 2020), dietary intake was assessed over two years using a food frequency questionnaire. Average diet quality was moderate to poor, with a mean score of 55 (HEI-2015, range 0–100) and there were no associations between dietary quality indices and measures of arterial stiffness and/or an interaction with levels of glycemic outcomes or BMI z-score.

In one retrospective cohort study (Nansel 2016) as a secondary analysis of the Cultivating Healthy Environments in Families With Type 1 Diabetes (CHEF) randomized controlled trial, dietary intake was assessed through three-day diet records at six-time points over 18 months, and diet quality was measured by the Healthy Eating Index 2005 (HEI-2005). In subjects receiving an intervention designed to improve carbohydrate quality and whole plant food density, mean HEI-2005 scores were 64.6 ± 2.0 , compared to 57.4 ± 1.6 in the control group. A1C was associated inversely with carbohydrate and natural sugar, and positively with protein and unsaturated fat. Greater glycemic targets as indicated by ≥ 1 continuous glucose monitoring variable were associated with higher HEI-2005, whole plant food density, fiber, carbohydrate, and natural sugar and lower glycemic index and unsaturated fat. In children and adolescents with T1DM, very low quality evidence indicates that improvements in diet quality [from an average Healthy Eating Index (HEI) score of 55/100 to a score of 65/100] were associated with better glycemic outcomes and certainty of evidence was very low quality.

o [Recommendation Strength Rationale](#)

The recommendation was based on Very Low quality evidence.

o [Minority Opinions](#)

None.

• [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6- 19 years old\) living with type 1 diabetes, what is the effect of higher diet quality scores compared to lower diet quality scores on glycemic outcomes?](#)

o [References](#)

[Liese A, Couch S, The N, Crandell J, Lawrence J, Crume T, Mayer-Davis E, Zhong V, Urbina E. Association between diet quality indices and arterial stiffness in youth with type 1 diabetes: SEARCH for Diabetes in Youth Nutrition Ancillary Study. *Journal of Diabetes and Its Complications* 2020; 34:107709](#)

[Nansel T, Lipsky L, Liu A. Greater diet quality is associated with more optimal glycemic control in a longitudinal study of youth with type 1 diabetes. *American Journal of Clinical Nutrition* 2016; 104:81-87](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)
 - Larson NI, Story MT, Nelson MC. Neighborhood environments: disparities in access to healthy foods in the U.S. *Am J Prev Med*. 2009;36(1):74-81 PMID: 18977112 doi: [10.1016/j.amepre.2008.09.025](#). Epub 2008 Nov 1.
 - Sheils JF, Rubin R, Stapleton DC. The estimated costs and savings of medical nutrition therapy: the Medicare population. *J Am Diet Assoc*. 1999;99(4):428-435. PMID: 10207394 doi: [10.1016/S0002-8223\(99\)00105-4](#)
- [Diabetes: Type 1 \(Pediatrics\)](#)
- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Carbohydrate Management Strategies (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Carbohydrate Management Strategies

In children and adolescents living with type 1 diabetes, a registered dietitian nutritionists or international equivalent should suggest carbohydrate counting or carbohydrate estimation as a strategy to effectively dose insulin to optimize glycemic management.

Rating: Level 2(C)
Conditional

- [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by an RDN for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select or if the individuals with diabetes cannot implement the appropriate carbohydrate management strategy. Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Conditions of Application](#)

RDNs should work within interdisciplinary teams to promote the implementation of nutrition care. Interdisciplinary team protocols should include nutrition screening and referral to an RDN for individualized MNT. Incorporation of nutrition screening and referral to RDNs requires coordination of administrators, and organizational policies and procedures. Issues like feasibility of implementation, values of interventions, and equity issues should be considered while developing care plans for clients.

The primary goal of implementing these recommendations is improving client outcomes while individualizing care to your client's preferences and health status. Although the costs of MNT sessions and reimbursement vary, MNT is significantly associated with improved client outcomes. MNT can be considered cost-effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities versus the cost of the interventions. The dietary recommendation can be implemented in numerous ways and hence is easy to incorporate into practice. This recommendation can be incorporated into ongoing counseling sessions and does not require any extra resources. However, there can be some barriers to providing care and the RDN should consider these when planning interventions for their clients. Issues like lack of insurance or higher out-of-pocket costs are more likely to impact the ability of certain demographics/groups to obtain care. Diabetes complications, both short and long-term, could be more frequent for those who have access problems, costing more for the individual, family, and the healthcare system as a whole. Limited services by RDNs in some areas (eg, rural) can also be a barrier.

The RDN should work with both children and adolescents with T1DM and their parents/caregivers, as they play a critical part in self-management in youth. The treatment plan should focus on normal growth and development of the individual along with dietary management. The RDNs should screen and assess the educational, psychological, emotional, behavioral, and access to food status of children and work with parents/caregivers to help implement the treatment plan.

- [Potential Costs Associated with Application](#)

The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Recommendation Narrative](#)

Nine studies regarding carbohydrate management strategies in pediatric T1DM reported on glycemic outcomes, body mass index outcomes and/or quality of life (Campbell et al, 2014; Dalsgaard et al, 2014; Donzeau et al, 2020; Enander et al, 2012; Goksen et al, 2014; Kostopoulou et al, 2020; Rabbone et al, 2014; Sauder et al, 2020; Spiegel et al, 2012).

Four randomized controlled trials (Donzeau 2020, Enander 2012; Goksen 2014, Spiegel 2012) studied the effectiveness of carbohydrate counting as a strategy to manage glycemia in pediatric individuals with T1DM. There was considerable heterogeneity among the comparator group or control group in the included studies. The comparator or control groups were mostly the exchange method (fixed amount of carbohydrate per meal) or plate exchange methods, and traditional diet approaches or dietary education. All these studies had low risk of bias for all domains of bias. In a meta-analysis of four randomized controlled trials, carbohydrate counting as a strategy to manage glycemia decreased HbA1c by a mean (95% CI) of -0.241% (-0.475, -0.007)($I^2=0$). Donzeau 2020 reported that advanced carbohydrate counting using insulin-to-carb ratios intervention was associated with 0.22% lower A1C after one year ($P < .05$), compared to traditional dietary education using fixed amounts of carbohydrates and insulin with exchange lists, and Goksen 2014 reported that the group using carbohydrate counting using insulin-to-carbohydrate ratios had significantly lower mean A1C levels ($P = .010$) than the group using traditional exchange-based meal plans. Whereas Enander 2012 reported no significant differences in A1C within or between groups after one year of either carbohydrate counting with a regular insulin pump, carbohydrate counting with a cozmo pump, or plate exchange methods (Enander 2012) and Spiegel 2012 reported A1C decreased in both carbohydrate counting nutrition education intervention or control group with a handout, but the results were not statistically significant (Spiegel 2012).

These findings from randomized controlled trials are aligned with the findings of one non-randomized study (Kostopoulou 2020) and four cohort studies (Campbell 2014, Dalsgaard 2014, Rabbone 2014, Sauder 2020). Kostopoulou 2020 reported a statistically significant reduction in A1C when subjects followed Period B (proper prandial insulin dosing based on the amount of carbohydrates contained in each meal) for four months compared to Period A (standard insulin dosing per meal) for four months ($P < .001$). Four cohort studies (class B evidence, Campbell 2014, Dalsgaard 2014, Rabbone 2014, Sauder 2020) report similar results. Campbell 2014 reported that subjects with excellent glycemic targets (A1C $<7\%$) were more likely to use meal-specific insulin:carbohydrate ratios ($P < .001$) than those with poor glycemic targets (A1C $\geq 9\%$) (Campbell 2014). Dalsgaard 2014 reported a significant difference in the percentage of adequacy of A1C ($P = .000$) after one year of Carbohydrate Counting/Carb Exchange Lists (CCHO, adhering to total amount of CHO at each meal) and no significant changes during one year of Traditional Diet/Caloric Exchange Lists (TD, each food exchange had 15 g CHO) (Dalsgaard 2014). Rabbone 2014 reported that when comparing patients using or not using carbohydrate counting, regardless of the automated bolus calculator, a significantly lower A1C was observed at all study points. Lastly, in Sauder 2020, A1C was lower among those who started tracking calories (-0.4% , $P < .05$) or often counted carbohydrates (-0.8% , $P < .001$) compared to those with less use (Sauder 2020). The evidence on this topic is characterized by a few well controlled experimental studies, small sample sizes, and heterogeneity in interventions and comparator groups. The certainty of evidence was very low quality.

Hence, to summarize, in children and adolescents with T1DM, low quality evidence suggests that carbohydrate counting (using insulin-to-carbohydrate ratio) can be an effective strategy to help reduce and provide continued maintenance of A1C goals. Small improvements in quality of life scores and overall confidence in prescribed dietary advice compared to other carbohydrate management strategies like carbohydrate consistency, plate method or exchange lists/food lists/carbohydrate choices were identified.

- [Recommendation Strength Rationale](#)

The certainty of evidence was very low quality

- [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of carbohydrate management strategies \(e.g.: carbohydrate counting alone; carbohydrate counting using insulin-to-carbohydrate ratios; carbohydrate consistency; plate method; exchange lists/food lists/carbohydrate choices\) compared to usual care on A1C and quality of life scores?](#)

- [References](#)

[Campbell M, Schatz D, Chen V, Wong J, Steck A, Tamborlane W, Smith J, Beck R, Cengiz E, Laffel L, Miller K, Haller M. A contrast between children and adolescents with excellent and poor control: the T1D Exchange clinic registry experience. *Pediatric Diabetes* 2014; 15:110-117](#)

[Dalsgaard H, Saunders C, Padilha P, Luescher J, Szundy Berardo R, Accioly E. Glycemic control and lipid profile of children and adolescents undergoing two different dietetic treatments for type 1 diabetes mellitus. *Nutricion Hospitalaria* 2014; 29:547-552](#)

[Donzeau A, Bonnemaison E, Vautier V, Menut V, Houdon L, Bendelac N, Bismuth E, Bouhours-Nouet N, Quemener E, Baron S, Nicolino M, Faure N, Pochelu S, Barat P, Coutant R. Effects of advanced carbohydrate counting on glucose control and quality of life in children with type 1 diabetes. *Pediatric Diabetes* 2020; 21:1240-1248](#)

[Enander R, Gundeval C, Strömberg A, Chaplin J, Hanas R. Carbohydrate counting with a bolus calculator improves post-prandial blood glucose levels in children and adolescents with type 1 diabetes using insulin pumps. *Pediatric Diabetes* 2012; 13:545-551](#)

[Goksen D, Atik Altinok Y, Ozen S, Demir G, Darcan S. Effects of carbohydrate counting method on metabolic control in children with type 1 diabetes mellitus. *Journal of Clinical Research in Pediatric Endocrinology* 2014; 6:74-78](#)

[Kostopoulou E, Livada I, Partsalaki I, Lamari F, Skiadopoulos S, Rojas Gil A, Spiliotis B. The role of carbohydrate counting in glycemic control and oxidative stress in patients with type 1 diabetes mellitus \(T1DM\). *Hormones \(Athens, Greece\)* 2020; 19:433-438](#)

[Rabbone I, Scaramuzza A, Ignaccolo M, Tinti D, Sicignano S, Redaelli F, De Angelis L, Bosetti A, Zuccotti G, Cerutti F. Carbohydrate counting with an automated bolus calculator helps to improve glycaemic control in children with type 1 diabetes using multiple daily injection therapy: an 18-month observational study. *Diabetes Research and Clinical Practice* 2014; 103:388-394](#)

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[Spiegel G, Bortsov A, Bishop F, Owen D, Klingensmith G, Mayer-Davis E, Maahs D. Randomized nutrition education intervention to improve carbohydrate counting in adolescents with type 1 diabetes study: is more intensive education needed?. *Journal of the Academy of Nutrition and Dietetics* 2012; 112:1736-1746](#)

- o [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

- Sheils JF, Rubin R, Stapleton DC. The estimated costs and savings of medical nutrition therapy: the Medicare population. *J Am Diet Assoc.* 1999;99 (4):428-435. PMID: 10207394 doi: [10.1016/S0002-8223\(99\)00105-4](#).

- [Diabetes: Type 1 \(Pediatrics\)](#)
- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Macronutrient Composition (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Individualize Macronutrient Composition

It is reasonable for a registered dietitian nutritionist or international equivalents, in collaboration with youth living with type 1 diabetes and their families to individualize the macronutrient composition of a healthy, energy appropriate eating plan to optimize glycemic outcomes.

Rating: Consensus
Conditional

- o [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by an RDN for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select or the individuals with diabetes cannot implement the appropriate carbohydrate management strategy. Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- o [Conditions of Application](#)

Recommendations focusing on dietary patterns, diet quality, and making appropriate changes in dietary intake without addressing food insecurity may inadvertently have potential risks and harms in some populations as implementation of this recommendation may not be accessible to underserved and vulnerable populations. Underserved and vulnerable populations are populations that face health, financial, educational, and/or housing disparities ([Serving Vulnerable and Underserved Populations](#). Accessed January 17, 2023). Access to supermarkets and convenience stores that have a variety of foods is known to be limited in neighborhoods with high minority populations and low population density, which could limit access to lower, healthier food choices (Larson 2009). Underserved and vulnerable populations with limited health literacy may not have access to nutrition education and resources that would facilitate making this change. Food insecurity may also serve as a potential barrier to following this guideline, as provision of adequate food and nutrients may take priority.

Acceptability

There is limited research on the acceptability of MNT provided by an RDN among children and adolescents with T1DM. However, this limited evidence indicates that children and adolescents living with T1DM understand that food plays a central role in the management of diabetes (Ye 2017). Stakeholders for these recommendations included children and with diabetes, families, caregivers, RDN's, health professionals, educators, and support services. Findings from Ye 2017 mention that teens are not only concerned about outcomes like management of their blood glucose but also their interactions with peers, and emotional well-being, to name a few. Based on the results from these articles, it is clear that children and adolescents living with T1DM and their parents/caregivers do value MNT from RDNs and understand that dietary knowledge and behavior are important for management of their blood glucose. Chalmers 2022 indicated that developing social media related tools or education materials to discuss T1DM might be helpful. Overall, evidence indicates that stakeholders desired a personalized approach, not just focusing on A1C management but also other outcomes like emotional and physical well-being, access to dietetic services, and a shared decision-making relationship with the RDN.

Implementation Considerations

RDNs should work within interdisciplinary teams to promote the implementation of nutrition care. Interdisciplinary team protocols should include nutrition screening and referral to RDNs for individualized MNT. Incorporation of nutrition screening and referral to RDNs requires coordination of administrators, and organizational policies and procedures. Issues like feasibility of implementation, values of interventions, and equity issues should be considered while developing care plans for clients.

The primary goal of implementing these recommendations is improving client outcomes while individualizing care to your client's preferences and health status. Although the costs of MNT sessions and reimbursement vary, MNT is significantly associated with improved client outcomes. MNT can be considered cost-effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities versus the cost of the interventions. The dietary recommendation can be implemented in numerous ways and hence is easy to incorporate into practice. This recommendation can be incorporated into ongoing counseling sessions and does not require any extra resources. However, there can be some barriers to providing care and RDNs should consider these when planning interventions for their clients. Issues like lack of insurance or higher out-of-pocket costs are more likely to impact the ability of certain demographics/groups to obtain care. Diabetes complications, both short and long-term, could be more frequent for those who have access problems, costing more for the individual, family, and the health-care system as a whole. Limited services by RDNs in some areas (eg, rural) can also be a barrier.

The RDN should work with both children and adolescents with T1DM and their parents/caregivers, as they play a critical part in self-management in youth. The treatment plan should focus on normal growth and development of the individual along with dietary management. The RDNs should screen and assess the educational, psychological, emotional, behavioral, and access to food status of children and work with parents/caregivers to help implement the treatment plan.

Additional information to consider when determining the best methods of implementing recommendations:

- Consider client's age, socio-economic status, cultural membership, psychological and mental health status, health history, and other individual and health conditions.
- Dietary pattern-focused interventions may have small to moderate benefits for individuals with diabetes and little to no harm.
- Benefits would include changes in diet that show an improvement in A1C and quality of life. Secondary benefits could be seen with improvements in lipid profiles, blood pressure, and optimizing of BMI through growth and development.
- Changes in diet quality or intake may result in hypoglycemia. Thus, practitioners must ensure families know how to treat low blood glucose and discuss insulin adjustments should there be a pattern of hypoglycemia. Insulin adjustments should always be considered before suggesting it.
- While providing counseling and care for individuals regarding dietary interventions, the RDN should evaluate for signs of disordered eating.
- At present there are no guidelines for best practice recommendations on vitamin D supplementation. Practitioners should use their own clinical expertise and individualize based on patients' needs.
- Consider all types of learning in teaching methods, including visual, kinesthetic, audible, and written, and include demonstrations and teaching back skills when appropriate.

○ [Potential Costs Associated with Application](#)

The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc. and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

○ [Recommendation Narrative](#)

There were no randomized controlled trials that clearly evaluated consumption of differing amounts of macronutrients compared to usual dietary intake, however, there were some observational studies that evaluated the association of total carbohydrate intake and outcomes of interest. These studies did not meet the inclusion criteria for answering this research question. The lack of evidence on this topic is likely related to the fact that clinical practice is focused on appropriately managing insulin to carbohydrate ratio rather than focusing on differing amounts of carbohydrate. There is a lack of evidence to study the effect of differing amounts of macronutrient consumption in youth with T1DM on nutrition-related outcomes.

○ [Recommendation Strength Rationale](#)

There was no evidence evaluating the effect of differing amounts of macronutrient consumption.

○ [Minority Opinions](#)

None.

● [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of differing amounts of macronutrient consumption compared to usual care on nutrition-related outcomes?](#)

- [References](#)
- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

- Chalmers K, Smith M, Moreno M, Malik F. "It Got Likes, But I Don't Think People Understood": A Qualitative Study of Adolescent Experiences Discussing Type 1 Diabetes on Social Media. *J Diabetes Sci Technol*. 2022;16(4):858-865. PMID: 33106051 doi: [10.1177/1932296820965588](https://doi.org/10.1177/1932296820965588). Epub 2020 Oct 27
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- Ye CY, Jeppson TC, Kleinmaus EM, Kliems HM, Schopp JM, Cox ED. Outcomes That Matter to Teens With Type 1 Diabetes. *Diabetes Educ*. 2017;43(3):251-259. PMID: 28520550 doi: [10.1177/0145721717699891](https://doi.org/10.1177/0145721717699891). Epub 2017 Mar 21.

- [Diabetes: Type 1 \(Pediatrics\)](#)
- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Dietary Patterns (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Dietary Patterns

For all children and adolescents living with type 1 diabetes, it is reasonable for the registered dietitian nutritionist or international equivalent to consider advising a dietary pattern, individualized for dietary preferences, nutrient needs, and available resources that promotes consumption of nutrient-dense foods.

Rating: Consensus
Conditional

- [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by an RDN for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select or if the individuals with diabetes cannot implement the appropriate carbohydrate management strategy. Potential harms such as financial costs, time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by an RDN are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Conditions of Application](#)

Barriers to Implementing

Access to RDN services may be limited by the number of professionals, the availability of these individuals and physical access to schedule. Families may experience burden due to the volume of appointments they are required to attend, despite the need/desire for the information provided by the service (and the support). Appointments may mean missing school (children/adolescents) and work (parents/caregivers) and lost wages. Also, increased travel costs, and childcare costs can be barriers to accessing care. Telehealth options can mitigate some of these issues.

Recommendations focusing on dietary patterns, diet quality, and making appropriate changes in dietary intake without addressing food insecurity may inadvertently have potential risks and harms in some populations as implementation of this recommendation may not be accessible to underserved and vulnerable populations. Underserved and vulnerable populations are populations that face health, financial, educational, and/or housing disparities ([Serving Vulnerable and Underserved Populations](#). Accessed January 17, 2023). Access to supermarkets and convenience stores that have a variety of foods is known to be limited in neighborhoods with high minority populations and low population density, which could limit access to lower, healthier food choices (Larson 2009). Underserved and vulnerable populations with limited health literacy may not have access to nutrition education and resources that would facilitate making this change. Food insecurity may also serve as a potential barrier to following this guideline, as provision of adequate food and nutrients may take priority.

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There is limited research on the acceptability of MNT provided by an RDN among children and adolescents with T1DM. However, this limited evidence indicates that children and adolescents living with T1DM understand that food plays a central role in the management of diabetes (Ye 2017). Stakeholders for these recommendations included children and adolescents with diabetes, families, caregivers, RDNs, health professionals, educators, and support services. Findings from Yes 2017 mention that teens are not only concerned about outcomes like management of their blood glucose, but also their interactions with peers, and emotional well-being, to name a few. Based on the results from these articles, it is clear that children and adolescents living with T1DM and their parents/caregivers do value MNT from RDNs and understand that dietary knowledge and behavior are important for management of their blood glucose. Chalmers 2022 indicated that developing social media related tools or education materials to discuss T1DM might be helpful. Overall, evidence indicates that stakeholders desired a

personalized approach, not just focusing on A1C management but also other outcomes like emotional and physical well-being, access to dietetic services, and a shared decision-making relationship with the RDN. Access to supermarkets and convenience stores that have a variety of foods is known to be limited in neighborhoods with high minority populations and low population density, which could limit access to lower healthier food choices (Larson 2009). Underserved and vulnerable populations with limited health literacy may not have access to nutrition education and resources that would facilitate making this change. Food insecurity may also serve as a potential barrier to following this guideline, as provision of adequate food and nutrients may take priority.

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The primary goal of implementing these recommendations is improving client outcomes while individualizing care to your client's preferences and health status. Although the costs of MNT sessions and reimbursement vary, MNT is significantly associated with improved client outcomes. MNT can be considered cost-effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities versus the cost of the interventions. The dietary recommendation can be implemented in numerous ways and hence is easy to incorporate into practice. This recommendation can be incorporated into ongoing counseling sessions and does not require any extra resources. However, there can be some barriers to providing care and RDNs should consider these when planning interventions for their clients. Issues like lack of insurance or higher out-of-pocket costs are more likely to impact the ability of certain demographics/groups to obtain care. Diabetes complications, both short and long-term, could be more frequent for those who have access problems, costing more for the individual, family, and the health-care system as a whole. Limited services by RDNs in some areas (eg, rural) can also be a barrier.

The RDN should work with both children and adolescents with T1DM and their parents/caregivers, as they play a critical part in self-management in youth. The treatment plan should focus on normal growth and development of the individual along with dietary management. The RDN should screen and assess the educational, psychological, emotional, behavioral, and access to food status of children and work with parents/caregivers to help implement the treatment plan.

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- Understanding average carbohydrate intake for age, weight, activity level.
- Calculating insulin dosages based on carbohydrate intake from foods and beverages.
- Quantifying carbohydrate quantities in foods when dining away from home.
- Choosing foods on a limited budget.
- Choosing foods to promote a healthy growth pattern.
- Defining healthy eating attitudes and behaviors to reduce the risk of disordered or dysfunctional eating.
- Managing hypoglycemia.
- Understanding nutrition guidelines for sick days.
- Understanding nutrition recommendations for religious/ethnic considerations (eg, fasting, foods avoided, etc.).
- Navigating eating and glycemic management while traveling.
- Understanding nutrition recommendations for exercise and physical activity to optimize glycemic goals, prevent hypoglycemia, and optimize performance through nutrition.
- For those interested in technology, introducing the use of apps to assist with tasks related to identifying & quantifying carbohydrate foods, tracking food intake, understanding the impact on different variables, including food, on blood glucose.
- Understanding the use of continuous glucose monitoring, insulin smart pen, and/or insulin pump data as diabetes self-management tools to aid in optimal post-prandial glycemia, management of hypoglycemia, and sports performance.

Additional information to consider when determining the best methods of implementing recommendations:

- Consider client's age, socio-economic status, cultural membership, psychological and mental health status, health history, and other individual and health conditions.
- Dietary pattern-focused interventions may have small to moderate benefits for individuals with diabetes and little to no harm. Benefits would include changes in diet that show an improvement in A1C and quality of life. Secondary benefits could be seen with improvements in lipid profiles, blood pressure, and optimizing of BMI through growth and development.
- Changes in diet quality or intake may result in hypoglycemia. Thus, practitioners must ensure families know how to treat low blood glucose and discuss insulin adjustments should there be a pattern of hypoglycemia. Insulin adjustments should always be considered before making suggestions.
- While providing counseling and care for individuals regarding dietary interventions, the RDN should evaluate for signs of disordered eating.
- At present there are no guidelines for best practice recommendations on vitamin D supplementation. Practitioners should use their own clinical expertise and individualize based on patients' needs.
- Consider all types of learning in teaching methods, including visual, kinesthetic, audible, and written, and include demonstrations and teaching back skills when appropriate.
- The Academy has developed [Implementing Evidence: from Guidelines to Daily Practice](#), a new resource which aims to assist nutrition and dietetics practitioners with implementing evidence-based practice recommendations and clinical practice innovations into daily practice.

RDNs are encouraged to incorporate *inclusion, diversity, equity, and access (IDEA)* in their practice when working with individuals living with T1DM. Addressing health inequities extends beyond providing individualized advice that considers social determinants of health and other barriers to healthy lifestyle behaviors. The Academy's membership website, eatrightPRO.org, includes a section titled "IDEA Hub" that provides resources for RDN's aiming to advance IDEA principles in their practices and professions. For example, providing dietary counseling on diet quality would probably create more equity quality, as some cultures do not value fruit, vegetables, and high fiber in the diet. Providing this education could help to improve overall health for all populations, thus improving health equity.

- o [Potential Costs Associated with Application](#)

Potential harms such as financial costs, time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by an RDN are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- o [Recommendation Narrative](#)

Four articles (Barnes et al, 2013; Costacou et al, 2018; Sauder et al, 2020; Zhong et al, 2016) from the SEARCH cohort study regarding dietary patterns in pediatric T1DM reported on glycemic outcomes and anthropometrics.

Mediterranean Dietary Pattern

Two cohort studies report no significant effects of the Mediterranean diet on glycemic and/or anthropometric outcomes. Costacou 2018 reported no significant associations were observed for diet quality characterized by Mediterranean mKIDMED indices in SEARCH cohort participants over five years of follow-up. Costacou 2018 is a prospective cohort study based on SEARCH cohort study to investigate diet quality and microalbuminuria using Mediterranean diet score (mKIDMED), DASH, and healthy eating index (HEI). Results indicated that adherence to higher-quality diets in this sample was low based on mKIDMED and DASH scores. Reported scores for HEI were better compared to mKIDMED or DASH, and greater adherence to HEI may be beneficial for kidney health.

Zhong 2016 reported that in SEARCH participants, only 3% had high Mediterranean diet scores, which was not associated with BMI z score or waist circumference, and a two-point increase in mKIDMED score was associated with 0.01% lower log-A1C (P=0.07, NS). Zhong 2016 conducted an association study of the Mediterranean diet and glycemic management and other cardiovascular risk factors in participants of SEARCH ancillary study (n=793). Adherence to a Mediterranean type of diet was assessed with the KIDMED index score, based on the SEARCH FFQ. At baseline, the results of the study indicated that only 2.8% of the participants had high Mediterranean diet scores, 45.8% had median score and 51.5% had a low score. These scores did not change much at 1-year and 5-year follow-up visits. Cross-sectional analysis of the data indicated higher Mediterranean diet scores were associated with lower A1C and an improved lipid profile. Both studies reported low adherence of the prescribed dietary pattern and no actual dietary intake was assessed.

DASH Dietary Pattern

In one prospective cohort study (class B evidence, Barnes 2013), an increase in DASH diet score was significantly associated with a decrease in A1C (beta = -0.20, P-value = 0.0063) but there were no significant associations between DASH diet score and BMI z-score or waist circumference. However, Costacou 2018 reported no significant associations were observed for diet quality characterized by DASH indices in SEARCH cohort participants over five years of follow-up. Barnes 2013 used SEARCH cohort study's longitudinal data to investigate if changes in DASH diet score are associated with change in cardiovascular disease (CVD) risk factors. A total of 617 youths with T1DM were followed over 60 months. There was very little change in DASH score at the 60-month visit compared to baseline score (-0.41 ± 11.2), however, several CVD risks factors did significantly increase at 60-month visit compared to baseline (diastolic BP 65.4 ± 9.2 vs 71.5 ± 8.3 mmHg; Systolic BP 105.2 ± 10.4 vs 110.7 ± 9.1 mmHg; total cholesterol 161.3 ± 31.8 vs 172.0 ± 37.4; triglycerides 71.6 ± 41.5 vs 111.6 ± 143.0 mg/dl; and A1c 7.97 ± 1.71 vs 9.31 ± 2.17). Major limitations of this study were the small sample size and poor adherence to the DASH dietary pattern and this did not change much over time.

Glycemic Index

In a prospective cohort study (class B evidence, Sauder 2020), for choosing low glycemic index foods, mean A1C was 0.3% to 0.6% lower among those who often, started, or sometimes used this strategy compared to those who stopped or never used it. A1C was lower among those who sometimes chose low glycemic index foods (-0.5%, P = .02) compared to those with less use. Sauder 2020 conducted a cross-sectional analysis of dietary strategies used by SEARCH participants (n=1558) over 5.5 years. Ten different dietary strategies were assessed using a questionnaire. Results indicated that participants who tracked calories, often counted carbohydrates, or often chose low glycemic index foods compared to those who used less of these strategies had lower A1C. However, due to the nature of the study design, there are some limitations eg, limited power, confounding between strategies used, sustained versus variable use of dietary strategies.

Overall, in children and adolescents with T1DM, effects of dietary patterns like Mediterranean, DASH, and low glycemic index on glycemic outcomes are inconclusive and the certainty of evidence is very low quality.

- o [Recommendation Strength Rationale](#)

The recommendation is rated conditional as the quality of supporting evidence ranges from very low to low.

- o [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of dietary pattern-focused interventions \(e.g.: Mediterranean, DASH, low glycemic index\) compared to usual care on A1C?](#)

- [References](#)

[Barnes T, Crandell J, Bell R, Mayer-Davis E, Dabelea D, Liese A. Change in DASH diet score and cardiovascular risk factors in youth with type 1 and type 2 diabetes mellitus: The SEARCH for Diabetes in Youth Study. *Nutrition & Diabetes* 2013; 3:e91](#)

[Costacou T, Crandell J, Kahkoska A, Liese A, Dabelea D, Lawrence J, Pettitt D, Reynolds K, Mayer-Davis E, Mottl A. Dietary Patterns Over Time and Microalbuminuria in Youth and Young Adults With Type 1 Diabetes: The SEARCH Nutrition Ancillary Study. *Diabetes Care* 2018; 41:1615-1622](#)

[Sauder K, Stafford J, The N, Mayer-Davis E, Thomas J, Lawrence J, Kim G, Siegel K, Jensen E, Shah A, D'Agostino R, Dabelea D. Dietary strategies to manage diabetes and glycemic control in youth and young adults with youth-onset type 1 and type 2 diabetes: The SEARCH for diabetes in youth study. *Pediatric Diabetes* 2020; 21:1093-1101](#)

[Zhong V, Lamichhane A, Crandell J, Couch S, Liese A, The N, Tzeel B, Dabelea D, Lawrence J, Marcovina S, Kim G, Mayer-Davis E. Association of adherence to a Mediterranean diet with glycemic control and cardiovascular risk factors in youth with type I diabetes: the SEARCH Nutrition Ancillary Study. *European Journal of Clinical Nutrition* 2016; 70:802-807](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

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- [Diabetes: Type 1 \(Pediatrics\)](#)

- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Vitamin D (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Vitamin D

In children and adolescents living with type 1 diabetes, we suggest prescribing Vitamin D supplementation in the form of cholecalciferol or ergocalciferol to correct 25(OH)D deficiency/insufficiency.

Rating: Level 2(C)

Conditional

- [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by an RDN for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select or if the individuals with diabetes cannot implement the appropriate carbohydrate management strategy. Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT by an RDN are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc., and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Conditions of Application](#)

Barriers to Implementing

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o [Potential Costs Associated with Application](#)

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o [Recommendation Narrative](#)

Six studies regarding vitamin D supplementation in children and adolescents living with T1DM reported on glycemic targets and/or anthropometrics (Giri et al, 2017; Nafei et al, 2017; Panjiyar et al, 2018; Sharma et al, 2017; Shih et al, 2016; Treiber et al, 2015). Of the six included studies, only two studies (Giri 2017 and Shih 2016) stratified their subjects by serum vitamin D levels of sufficient, insufficient, and deficient. The remaining four studies (Nafei 2017, Panjiyar 2018, Sharma 2017, Treiber 2015) pooled the results of supplementing their vitamin D-sufficient, insufficient, and deficient patients and/or used different cutoffs to determine which patients were sufficient, insufficient or deficient. Furthermore, all studies used varying dosages and durations of vitamin D supplementation, with some studies basing it on body weight: 400 – 6, 000 IU per day, 20, 000 IU per week, or 60, 000-120, 000 IU per month, for periods of three months to one year. All of these issues present challenges to synthesizing the evidence.

Glycemic Outcomes

In one randomized controlled trial (Nafei 2017), children were randomized into three groups: Group 1 of newly diagnosed children receiving 2000 IU vitamin D3 per day combined with a daily insulin regimen for three months; Group 2 of newly diagnosed children receiving a daily insulin regimen only for three months; and Group 3 of healthy children receiving no intervention. Serum levels of vitamin D at baseline were lower in Groups 1 and 2 compared to healthy children in Group 3. After three months, Group 1 patients treated with vitamin D3 had significant decreases in A1C levels ($P > .01$) compared with pre-treatment values.

In a second randomized controlled trial (Sharma 2017), children and adolescents received cholecalciferol supplementation once per month for six months, with the dosage depending on age (1-3 years: 60, 000 IU, 4-8 years: 90, 000 IU, 9-18 years: 120, 000 IU) or standard insulin therapy only. Vitamin D deficiency was present in 33 subjects (63.5%). At six months, there was no significant difference in A1C between groups.

In a third randomized controlled trial (Shih 2016), 63% of an adolescent cohort with T1DM was vitamin D deficient and randomized to vitamin D supplementation or delayed treatment. Subjects received 20, 000 IU/week vitamin D3 for six months, either immediately or after six months of observation; this increased serum levels of 25-OH vitamin D but did not affect A1C.

In a fourth randomized placebo-controlled trial (Treiber 2015), children and adolescents in the Cholecalciferol Supplementation Group received 140 IU/kg BW/day for one month and 70 IU/kg BW/day for eleven months. Approximately 63% of subjects had a serum 25(OH)D level in the

vitamin D deficient (<50 nmol/L) or insufficient (50-75 nmol/L) range. Over 12 months, serum 25(OH)D levels increased significantly in the treatment group and remained higher than the levels in the placebo group ($p<.001$) but A1C remained similar between groups.

In a retrospective cohort study (Giri 2017), 14.8% of the whole cohort ($n= 271$) were vitamin D deficient [25(OH)D <30 nmol/L] and 31% were insufficient [25(OH)D 30–50 nmol/L]. Medical charts of 73 participants were reviewed; 43 vitamin D insufficient patients received 400 units of cholecalciferol per day and 30 vitamin D deficient patients received 6,000 units of cholecalciferol per day for three months. Baseline A1C was $73.5(\pm 14.9)$ mmol/mol and after three months it decreased to 65 ± 11.2 mmol/mol ($P < 0.001$). Children with higher pre-treatment A1C had a greater reduction in A1C ($P < 0.001$) and those with a lower 25(OH)D concentration showed higher reduction in A1C ($P = 0.004$) after treatment. Low 25(OH)D concentrations are fairly prevalent in children and adolescents with T1DM and treatment with cholecalciferol can potentially improve glycemic management.

In a non-randomized controlled study (Panjiyar 2018), children in the intervention group received 3000 IU cholecalciferol per day for 12 months, while those in the control group received no supplementation. The mean total 25-(OH)D concentrations were similar in the two groups at baseline but increased in the intervention group after supplementation and remained in the sufficiency range (>30 ng/mL) at all visits, while levels decreased in the control group during the 12-month follow-up. The mean decrease in A1C between the groups reached statistical significance at 12 months ($P=0.04$).

Of the included studies, three studies reported c-peptide levels. Some data suggests that the vitamin D system plays an important role in the regulation of tolerance of self-antigens such as those displayed by the beta cells. Vitamin D deficiency may be related to a loss of self-tolerance to the antigens displayed by the pancreatic beta cells. Vitamin D supplementation improved c-peptide levels in newly-diagnosed youth with T1DM (Atai-Jafari 2013). While some study results suggest vitamin D supplementation may preserve beta-cell function, it is not clear how long this effect lasts. Preserving residual beta-cell function may contribute to lower incidence of hypoglycemia and reduced complication rates. However, these relationships are associations only and inconclusive whether this is only a short-term effect.

Overall, low certainty of evidence indicates that in youth with T1DM, vitamin D insufficiency (defined as serum 25-hydroxyvitamin D [25(OH)D] concentrations of 30–50 nmol/L or 12–20 ng/mL) and/or deficiency (defined as serum 25-hydroxyvitamin D [25(OH)D] concentrations of <30 nmol/L or <12 ng/mL) are common, affecting as many as 63% of patients. Vitamin D supplementation repletes vitamin deficiency, but its effect on glycemic management is inconclusive.

- [Recommendation Strength Rationale](#)

The evidence supporting the recommendation is based on C (Low) quality evidence.

- [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of vitamin D supplementation compared to no supplementation on A1C?](#)

- [References](#)

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- [Diabetes: Type 1 \(Pediatrics\)](#)
- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Culturally Relevant/Responsive Nutrition (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Culturally Relevant/Responsive Nutrition Interventions

The registered dietitian nutritionist or international equivalent should work in collaboration with children and adolescents with type 1 diabetes and their family to develop an individualized developmentally appropriate nutrition prescription plan that is tailored to each client's personal preferences (eg, tradition, culture, religion, health beliefs and goals), available resources (eg, food retailers, transportation, culinary/kitchen equipment, time), stage of behavior change, and a variety of eating patterns (different foods or food groups) to help optimize glycemic management.

Rating: Level 2(D)

Conditional

Rating: Level 2(D)

Conditional

- [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by an RDN for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select or if the individuals with diabetes cannot implement the appropriate carbohydrate management strategy. Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Conditions of Application](#)

Barriers to Implementing

Access to RDN services may be limited by the number of professionals, the availability of these individuals and physical access to schedule. Families may experience burden due to the volume of appointments they are required to attend, despite the need/desire for the information provided by the service (and the support). Appointments may mean missing school (children/adolescents) and work (parents/caregivers) and lost wages. Also, increased travel costs, and childcare costs can be barriers to accessing care. Telehealth options can mitigate some of these issues.

Recommendations focusing on dietary patterns, diet quality, and making appropriate changes in dietary intake without addressing food insecurity may inadvertently have potential risks and harms in some populations as implementation of this recommendation may not be accessible to underserved and vulnerable populations. Underserved and vulnerable populations are populations that face health, financial, educational, and/or housing disparities ([Serving Vulnerable and Underserved Populations](#). Accessed January 17, 2023). Access to supermarkets and convenience stores that have a variety of foods is known to be limited in neighborhoods with high minority populations and low population density, which could limit access to lower, healthier food choices (Larson 2009). Underserved and vulnerable populations with limited health literacy may not have access to nutrition education and resources that would facilitate making this change. Food insecurity may also serve as a potential barrier to following this guideline, as provision of adequate food and nutrients may take priority.

Acceptability

There is limited research on the acceptability of MNT provided by RDNs among children and adolescents with T1DM. However, this limited evidence indicates that children and adolescents living with type 1 diabetes understand that food plays a central role in the management of diabetes (Ye 2017). Stakeholders for these recommendations included children and adolescents with diabetes, families, caregivers, RDNs, health professionals, educators, and support services. Findings from Ye 2017 mention that teens are not only concerned about outcomes like

management of their blood glucose but also their interactions with peers, and emotional well-being, to name a few. Based on the results from these articles, it is clear that children and adolescents living with T1DM and their parents/caregivers do value MNT from RDNs and understand that dietary knowledge and behavior are important for management of their blood glucose. Chalmers 2022 indicated that developing social media related tools or education materials to discuss T1DM might be helpful. Overall, evidence indicates that stakeholders desired a personalized approach, not just focusing on A1C management but also other outcomes like emotional and physical well-being, access to dietetic services, and a shared decision-making relationship with the RDN.

Implementation Considerations

RDNs should work within interdisciplinary teams to promote the implementation of nutrition care. Interdisciplinary team protocols should include nutrition screening and referral to an RDN for individualized MNT. Incorporation of nutrition screening and referral to RDNs requires coordination of administrators, and organizational policies and procedures. Issues like feasibility of implementation, values of interventions, and equity issues should be considered while developing care plans for clients.

The primary goal of implementing these recommendations is improving client outcomes while individualizing care to your client's preferences and health status. Although the costs of MNT sessions and reimbursement vary, MNT is significantly associated with improved client outcomes. MNT can be considered cost-effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities versus the cost of the interventions. The dietary recommendation can be implemented in numerous ways and hence is easy to incorporate into practice. This recommendation can be incorporated into ongoing counseling sessions and does not require any extra resources. However, there can be some barriers to providing care and RDNs should consider these when planning interventions for their clients. Issues like lack of insurance or higher out-of-pocket costs are more likely to impact the ability of certain demographics/groups to obtain care. Diabetes complications, both short and long-term, could be more frequent for those who have access problems, costing more for the individual, family, and the health-care system as a whole. Limited services by RDNs in some areas (eg, rural) can also be a barrier.

The RDN should work with both children and adolescents with T1DM and their parents/caregivers, as they play a critical part in self-management in youth. The treatment plan should focus on normal growth and development of the individual along with dietary management. The RDN should screen and assess the educational, psychological, emotional, behavioral, and access to food status of children and work with parents/caregivers to help implement the treatment plan.

RDNs can play a central role in helping individuals obtain the skills needed to balance dietary intake, quality of life, and glycemic goals. Potential skills to assist with:

- Identifying and quantifying carbohydrate foods.
- Understanding average carbohydrate intake for age, weight, activity level.
- Calculating insulin dosages based on carbohydrate intake from foods and beverages.
- Quantifying carbohydrate quantities in foods when dining away from home.
- Choosing foods on a limited budget.
- Choosing foods to promote a healthy growth pattern.
- Defining healthy eating attitudes and behaviors to reduce the risk of disordered or dysfunctional eating.
- Managing hypoglycemia.
- Understanding nutrition guidelines for sick days.
- Understanding nutrition recommendations for religious/ethnic considerations (eg, fasting, foods avoided, etc.).
- Navigating eating and glycemic management while traveling.
- Understanding nutrition recommendations for exercise and physical activity to optimize glycemic goals, prevent hypoglycemia, and optimize performance through nutrition.
- For those interested in technology, introducing the use of apps to assist with tasks related to identifying & quantifying carbohydrate foods, tracking food intake, understanding the impact on different variables, including food, on blood glucose.
- Understanding the use of continuous glucose monitoring, insulin smart pen, and/or insulin pump data as diabetes self-management tools to aid in optimal post-prandial glycemia, management of hypoglycemia, and sports performance.

Additional information to consider when determining the best methods of implementing recommendations:

- Consider client's age, socio-economic status, cultural membership, psychological and mental health status, health history, and other individual and health conditions.
- Dietary pattern-focused interventions may have small to moderate benefits for individuals with diabetes and little to no harm. Benefits would include changes in diet that show an improvement in A1C and quality of life. Secondary benefits could be seen with improvements in lipid profiles, blood pressure, and optimizing of BMI through growth and development.
- Changes in diet quality or intake may result in hypoglycemia. Thus, practitioners must ensure families know how to treat low blood glucose and discuss insulin adjustments should there be a pattern of hypoglycemia. Insulin adjustments should always be considered before suggesting.
- While providing counseling and care for individuals regarding dietary interventions, the RDN should evaluate for signs of disordered eating.
- At present there are no guidelines for best practice recommendations on vitamin D supplementation. Practitioners should use their own clinical expertise and individualize based on patients' needs.
- Consider all types of learning in teaching methods, including visual, kinesthetic, audible, and written, and include demonstrations and teaching back skills when appropriate.
- The Academy has developed [Implementing Evidence: from Guidelines to Daily Practice](#), a new resource which aims to assist RDNs with implementing evidence-based practice recommendations and clinical practice innovations into daily practice.

RDNs are encouraged to incorporate *inclusion, diversity, equity, and access (IDEA)* in their practice when working with individuals living with T1DM. Addressing health inequities extends beyond providing individualized advice that considers social determinants of health and other barriers to healthy lifestyle behaviors. The Academy's member website, eatrightPRO.org, includes a section titled "IDEA Hub" that provides resources for RDNs aiming to advance IDEA principles in their practices and professions. For example, providing dietary counseling on diet quality would probably create more equity quality, as some cultures do not value fruit, vegetables, and high fiber in the diet. Providing this education could help to improve overall health for all populations, thus improving health equity.

- o [Potential Costs Associated with Application](#)

Potential harms such as financial costs, time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- o [Recommendation Narrative](#)

In children and adolescents with T1DM, evidence indicates that providing culturally relevant nutritional interventions increases the ability to achieve improvements in the HbA1c target and occurrence of adverse events. Two studies regarding culturally relevant interventions in pediatric T1DM reported on glycemic targets and/or adverse events (Iovane 2018 and Pascual 2019). Pascual 2019, a prospective cohort study evaluated the impact of using a Spanish-speaking staff facilitating group education sessions with culturally relevant materials (2-10 patients per group and their families, divided by age, either 1-11 years old or 12-20 years old) with routine care. For participants <12 years old, there was significant improvement in A1C from baseline to year one (P = .0146) and from year one to year two (P = .0069). However, participants >12 years old had an increase in A1C from year one to year two (P = .0082). The culturally sensitive shared medical appointments were an appreciated, feasible and effective alternative to care.

Iovane 2018, a non-randomized controlled trial, studied children from ethnic minorities (born in Italy from migrant parents coming from a country outside Europe: Indian, Moroccan, Tunisian, Romanian) and received the standard protocol for 12 months, as well as booklets translated into ethnic minority languages, weekly visits at home or at school, family-guides and clinic visits supported by professional interpreters. Despite glycemic management being poorer at diagnosis and a higher number of calls to the emergency toll-free telephone number in the families with children from ethnic minorities, all children showed a similar decrease in A1C during the first three- and six-months post diagnosis and patients did not differ in mean insulin doses at discharge and at follow up. The tailored support allowed children from ethnic minorities to achieve the same optimal glycemic outcomes as their peers.

Overall, low quality evidence indicates that providing culturally relevant/responsive nutrition interventions increases the ability to achieve improvements in A1C target and occurrence of adverse events.

- o [Recommendation Strength Rationale](#)

The evidence supporting the recommendations is based on very low quality evidence (D).

- o [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of culturally relevant/responsive nutrition interventions on A1C?](#)

- o [References](#)

[Iovane B, Cangelosi A, Bonaccini I, Mastroianni C, Di Mauro D, Fainardi V, Chiari G, Maltese M, Caffarelli C, Vanelli M. Effectiveness of a tailored medical support to overcome the barriers to education, treatment and good metabolic control in children with type-1 diabetes from ethnic minorities. *Acta Bio-Medica : Atenei Parmensis* 2018; 88:477-482](#)

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- o [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

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- Larson NI, Story MT, Nelson MC. Neighborhood environments: disparities in access to healthy foods in the U.S. *Am J Prev Med*. 2009;36(1):74-81. PMID: 18977112 doi:[10.1016/j.amepre.2008.09.025](https://doi.org/10.1016/j.amepre.2008.09.025). Epub 2008 Nov 1.
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- Ye CY, Jeppson TC, Kleinmaus EM, Kliems HM, Schopp JM, Cox ED. Outcomes That Matter to Teens With Type 1 Diabetes. *Diabetes Educ*. 2017;43(3):251-259. PMID: 28520550 doi: [10.1177/0145721717699891](https://doi.org/10.1177/0145721717699891). Epub 2017 Mar 21.

- [Diabetes: Type 1 \(Pediatrics\)](#)
- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Food Insecurity (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Food Insecurity

It is reasonable for healthcare professionals to screen for food insecurity, housing stability/homelessness, health literacy, financial barriers, and social/community support and apply that information to treatment decisions.

Rating: Consensus
Conditional

- [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by an RDN for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select or if the individuals with diabetes cannot implement the appropriate carbohydrate management strategy. Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by an RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Conditions of Application](#)

Barriers to Implementing

Access to RDN services may be limited by the number of professionals, the availability of these individuals and physical access to schedule. Families may experience burden due to the volume of appointments they are required to attend, despite the need/desire of the information provided by the service (and the support). Appointments may mean missing school (children/adolescents) and work (parents/caregivers) and lost wages. Also, increased travel costs, and childcare costs can be barriers to accessing care. Telehealth options can mitigate some of these issues.

Recommendations focusing on dietary patterns, diet quality, and making appropriate changes in dietary intake without addressing food insecurity may inadvertently have potential risks and harms in some populations as implementation of this recommendation may not be accessible to underserved and vulnerable populations. Underserved and vulnerable populations are populations that face health, financial, educational, and/or housing disparities ([Serving Vulnerable and Underserved Populations](#). Accessed January 17, 2023). Access to supermarkets and convenience stores that have a variety of foods is known to be limited in neighborhoods with high minority populations and low population density, which could limit access to lower, healthier food choices (Larson 2009). Underserved and vulnerable populations with limited health literacy may not have access to nutrition education and resources that would facilitate making this change. Food insecurity may also serve as a potential barrier to following this guideline, as provision of adequate food and nutrients may take priority.

Acceptability

There is limited research on the acceptability of MNT provided by an RDN among children and adolescents with T1DM. However, this limited evidence indicates that children and adolescents living with T1DM understand that food plays a central role in the management of diabetes (Ye 2017). Stakeholders for these recommendations included children and adolescents with T1DM, families, caregivers, RDNs, health professionals, educators, and support services. Findings from Ye 2017 mention that teens are not only concerned about outcomes like management of their blood glucose but also their interactions with peers, and emotional well-being, to name a few. Based on the results from these articles, it is clear that children and adolescents living with T1DM and their parents/caregivers do value MNT from RDNs and understand that dietary knowledge and behavior are important for management of their blood glucose. Chalmers 2022 indicated that developing social media related tools or education materials to discuss T1DM might be helpful. Overall, evidence indicates that stakeholders desired a personalized approach, not just focusing on A1C management but also other outcomes like emotional and physical well-being, access to dietetic services, and a shared decision-making relationship with the RDN.

Implementation Considerations

RDNs should work within interdisciplinary teams to promote the implementation of nutrition care. Interdisciplinary team protocols should include nutrition screening and referral to an RDN for individualized MNT. Incorporation of nutrition screening and referral to RDNs requires coordination of administrators, and organizational policies and procedures. Issues like feasibility of implementation, values of interventions, and equity issues should be considered while developing care plans for clients.

The primary goal of implementing these recommendations is improving client outcomes while individualizing care to your client's preferences and health status. Although the costs of MNT sessions and reimbursement vary, MNT is significantly associated with improved client outcomes. MNT can be considered cost-effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities versus the cost of the interventions. The dietary recommendation can be implemented in numerous ways and hence is easy to incorporate into practice. This recommendation can be incorporated into ongoing counseling sessions and does not require any extra resources. However, there can be some barriers to providing care and RDNs should consider these when planning interventions for their clients. Issues like lack of insurance or higher out-of-pocket costs are more likely to impact the ability of certain demographics/groups to obtain care. Diabetes complications, both short and long-term, could be more frequent for those who have access problems, costing more for the individual, family, and the health-care system as a whole. Limited services by RDNs in some areas (eg, rural) can also be a barrier.

The RDN should work with both children and adolescents with T1DM and their parents/caregivers, as they play a critical part in self-management in youth. The treatment plan should focus on normal growth and development of the individual along with dietary management. The RDN should screen and assess the educational, psychological, emotional, behavioral, and access to food status of children and work with parents/caregivers to help implement the treatment plan.

RDNs can play a central role in helping individuals obtain the skills needed to balance dietary intake, quality of life, and glycemic goals. Potential skills to assist with:

- Identifying and quantifying carbohydrate foods.
- Understanding average carbohydrate intake for age, weight, activity level.
- Calculating insulin dosages based on carbohydrate intake from foods and beverages.
- Quantifying carbohydrate quantities in foods when dining away from home.
- Choosing foods on a limited budget.
- Choosing foods to promote a healthy growth pattern.
- Defining healthy eating attitudes and behaviors to reduce the risk of disordered or dysfunctional eating.
- Managing hypoglycemia.
- Understanding nutrition guidelines for sick days.
- Understanding nutrition recommendations for religious/ethnic considerations (eg, fasting, foods avoided, etc.).
- Navigating eating and glycemic management while traveling.
- Understanding nutrition recommendations for exercise and physical activity to optimize glycemic goals, prevent hypoglycemia, and optimize performance through nutrition.
- For those interested in technology, introducing the use of apps to assist with tasks related to identifying & quantifying carbohydrate foods, tracking food intake, understanding the impact on different variables, including food, on blood glucose.
- Understanding the use of continuous glucose monitoring, insulin smart pen, and/or insulin pump data as diabetes self-management tools to aid in optimal post-prandial glycemia, management of hypoglycemia, and sports performance.

Additional information to consider when determining the best methods of implementing recommendations:

- Consider client's age, socio-economic status, cultural membership, psychological and mental health status, health history, and other individual and health conditions.
- Dietary pattern-focused interventions may have small to moderate benefits for individuals with diabetes and little to no harm. Benefits would include changes in diet that show an improvement in A1c and quality of life. Secondary benefits could be seen with improvements in lipid profiles, blood pressure, and optimizing of BMI through growth and development.
- Changes in diet quality or intake may result in hypoglycemia. Thus, practitioners must ensure families know how to treat low blood glucose and discuss insulin adjustments should there be a pattern of hypoglycemia. Insulin adjustments should always be considered before suggesting.
- While providing counseling and care for individuals regarding dietary interventions, RDNs should evaluate for signs of disordered eating.
- At present there are no guidelines for best practice recommendations on vitamin D supplementation. Practitioners should use their own clinical expertise and individualize based on patients' needs.
- Consider all types of learning in teaching methods, including visual, kinesthetic, audible, and written, and include demonstrations and teaching back skills when appropriate.
- The Academy has developed [Implementing Evidence: from Guidelines to Daily Practice](#), a new resource which aims to assist nutrition and dietetics practitioners with implementing evidence-based practice recommendations and clinical practice innovations into daily practice.

RDNs are encouraged to incorporate *inclusion, diversity, equity, and access (IDEA)* in their practice when working with individuals living with T1DM. Addressing health inequities extends beyond providing individualized advice that considers social determinants of health and other barriers to healthy lifestyle behaviors. The Academy's member website, [eatrightPRO.org](#), includes a section titled "IDEA Hub" that provides resources for RDNs aiming to advance IDEA principles in their practices and professions. For example, providing dietary counseling on diet quality would probably create more equity as some cultures do not value fruit, vegetables, and high fiber in the diet. Providing this education could help to improve overall health for all populations, thus improving health equity.

o [Potential Costs Associated with Application](#)

Potential harms such as financial costs, time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by an RDN are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc, and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Recommendation Narrative](#)

One study regarding food insecurity and socioeconomic status in pediatric T1DM reported on glycemic control and/or adverse events (Allassaf 2019). In one retrospective cohort study (class B evidence, Allassaf 2019), children whose mothers had a bachelor's degree or higher were less likely to have poor glycemic control compared to children whose mothers had only elementary education (OR: 0.241, CI: 0.079 - 0.734; P=.012). Children with deceased mothers had significantly higher A1C of 10.6±1.86% compared to an average of 8.7±1.45% for children with living mothers (P=.005). The percentage of patients with at least one episode of diabetic ketoacidosis (DKA), hospitalization and/or emergency room visits due to hyperglycemia was significantly lower in those with A1C <7.5% compared to >7.5%: 0% vs 9.2%: P=.022; 3.8% vs 17.5%, p=.012; and 0% vs 9.2%, P=.022, respectively. Low socioeconomic status, lower levels of maternal education and maternal death were all associated with poor glycemic control.

Overall, very low quality evidence indicates that low socioeconomic status and lower maternal education are associated with poor glycemic outcomes and increased occurrence of adverse events, such as diabetic ketoacidosis, hospitalization, and emergency room calls and visits.

- [Recommendation Strength Rationale](#)

This recommendation is based on expert consensus of the expert panel.

- [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the association between food insecurity / socioeconomic status and glycemic outcomes and adverse events?](#)

- [References](#)

[Allassaf A, Odeh R, Gharaibeh L, Ibrahim S, Ajlouni K. Impact of Socioeconomic Characteristics on Metabolic Control in Children with Type 1 Diabetes in a Developing Country. *Journal of Clinical Research in Pediatric Endocrinology* 2019; 11:358-365](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

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- [Diabetes: Type 1 \(Pediatrics\)](#)

- [Diabetes Type 1 Pediatrics \(T1DM\): Guideline \(2020-24\)](#)

T1DM: Monitoring and Evaluation: Medical Nutrition Therapy (2024)

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

T1DM: Effectiveness of Medical Nutrition Therapy

In children and adolescents living with type 1 diabetes, it is reasonable for a registered dietitian nutritionist or international equivalent to assess/reassess the following areas during follow-up interventions/visits:

- Diabetes-focused reassessment of dietary intake, nutrient needs, nutrition and/or carbohydrate management.
- Growth trajectory of the child/adolescent relative to their personal growth history and the typical growth of other children/adolescents of the same age and sex.
- Knowledge, skills, competencies of diabetes management tasks and need for additional training and education.
- Progress on behavioral goals.
- Monitor blood glucose and insulin dosing data to help optimize both food intake and related insulin dosing and timing with meals.
- Readiness in a client's ability to perform diabetes self-management tasks, particularly in an adolescent transition to self-care.
- Effectiveness of strategies to address learning barriers and readiness to change.
- Disordered eating behaviors.

- Psychosocial needs or barriers.
- Diabetes distress and depression.

Rating: Consensus

Imperative

T1DM: Medical Nutrition Therapy Follow-Up Encounters

The registered dietitian nutritionist or international equivalent should implement additional encounters to help children and adolescents and support persons adjust nutrition planning in concert with the changes and adjustments to insulin therapy until consistent goals are met (eg, blood glucose levels, time in range, A1C). More visits are likely to be needed in the first 6–12 months following diagnosis of type 1 diabetes. A minimum of one annual medical nutrition therapy follow-up encounter is needed. With growth and development, nutrition and insulin need to change frequently, so more encounters may be needed if diabetes care goals are not met.

Rating: Consensus

Imperative

- [Risks/Harms of Implementing This Recommendation](#)

There are few adverse events reported with MNT interventions provided by RDNs for children and adolescents with T1DM. However, hypoglycemia, hyperglycemia or weight gain may result if the RDN does not select or the individuals with diabetes cannot implement the appropriate carbohydrate management strategy. Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc., and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create moderate savings.

- [Conditions of Application](#)

Significant changes in disease treatment plans warrant full nutrition assessment and newly diagnosed individuals will have different needs compared to follow-up visits. There is the potential that individuals and families with lower socio-economic status will have more difficulty paying for additional expenses that they might incur while managing their children's condition. In these cases, practitioners may offer low-cost options to help them manage their needs.

- [Potential Costs Associated with Application](#)

Potential harms such as financial costs (Sheils 1999), time spent at clinic visits, psychological concerns and potential for anxiety related to MNT provided by RDNs are relatively minimal compared with the potential benefits of improved nutrition status and decreased disease progression. The cost-benefit ratio of MNT provided by the RDN is unlikely to be very high and if MNT is successful, the benefits may outweigh the financial costs. Coverage for services varies by state, payor, etc., and this can lead to varying out-of-pocket costs. These costs would be anticipated to be less than the cost of continuing the reduced access/low number of RDNs. Cost is minimal compared to potential benefits, especially considering the long-term cost of ill-health to government, hospitals, etc. Prevention of additional illness could create a moderate saving.

- [Recommendation Narrative](#)

Evidence indicates that periodically evaluating growth, anthropometric parameters, and assessing the nutritional status should be considered during regular follow-up visits of children and adolescents living with T1DM (Grabia 2021, Hill-Briggs 2020). Managing diabetes during childhood and adolescence places a burden on the youth and family, and hence the RDN should conduct ongoing assessments of psychosocial status, social determinants of health, and diabetes distress in the youth and the parents/caregivers during routine diabetes visits (Hill-Briggs 2020, Hagger 2016).

In children and adolescents with T1DM, low quality evidence reported that weekly MNT sessions for the first month after diagnosis and monthly sessions thereafter achieved significant reductions in A1C. For those receiving less frequent encounters with RDNs, evidence reports mixed findings on the effectiveness of MNT.

- [Recommendation Strength Rationale](#)

This recommendation is based on consensus of expert panel members.

- [Minority Opinions](#)

None.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[In children and adolescents \(6-19 years old\) living with type 1 diabetes, what is the effect of medical nutrition therapy provided by registered dietitian nutritionists compared to no standard care on A1C?](#)

- [References](#)

[Bakir E, Çavusoglu H, Mengen E. Effects of the Information-Motivation-Behavioral Skills Model on Metabolic Control of Adolescents with Type 1 Diabetes in Turkey: Randomized Controlled Study. *Journal of Pediatric Nursing* 2021; 58:e19-e27](#)

[Dluzniak-Golaska K, Panczyk M, Szypowska A, Sinska B, Szostak-Wegierek D. Influence of two different methods of nutrition education on the quality of life in children and adolescents with type 1 diabetes mellitus - a randomized study. *Roczniki Panstwowego Zakladu Higieny* 2020; 71:197-206](#)

[Donzeau A, Bonnemaison E, Vautier V, Menut V, Houdon L, Bendelac N, Bismuth E, Bouhours-Nouet N, Quemener E, Baron S, Nicolino M, Faure N, Pochelu S, Barat P, Coutant R. Effects of advanced carbohydrate counting on glucose control and quality of life in children with type 1 diabetes. *Pediatric Diabetes* 2020; 21:1240-1248](#)

[Kostopoulou E, Livada I, Partsalaki I, Lamari F, Skiadopoulos S, Rojas Gil A, Spiliotis B. The role of carbohydrate counting in glycemic control and oxidative stress in patients with type 1 diabetes mellitus \(T1DM\). *Hormones \(Athens, Greece\)* 2020; 19:433-438](#)

[Majumdar I, Bethin K, Quattrin T. Weight trajectory of youth with new-onset type 1 diabetes comparing standard and enhanced dietary education. *Endocrine* 2014; 49:155-162](#)

[Spiegel G, Bortsov A, Bishop F, Owen D, Klingensmith G, Mayer-Davis E, Maahs D. Randomized nutrition education intervention to improve carbohydrate counting in adolescents with type 1 diabetes study: is more intensive education needed?. *Journal of the Academy of Nutrition and Dietetics* 2012; 112:1736-1746](#)

o [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

- Grabia M, Markiewicz-Zukowska R. Nutritional Status of Pediatric Patients with Type 1 Diabetes Mellitus from Northeast Poland: A Case-Control Study. *Diabetes Ther.* 2021 Jan;12(1):329-343. PMID: 33289859 doi: 10.1007/s13300-020-00972-1 Epub 2020 Dec 8.
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- Hill-Briggs F, Adler NE, Berkowitz SA, et al. Social Determinants of Health and Diabetes: A Scientific Review. *Diabetes Care.* 2020 Nov 2;44(1):258-279. PMID: 33139407 doi: 10.2337/dci20-0053
- Sheils JF, Rubin R, Stapleton DC. The estimated costs and savings of medical nutrition therapy: the Medicare population. *J Am Diet Assoc.* 1999;99(4):428-435. PMID: 10207394 doi: 10.1016/S0002-8223(99)00105-4

T1DM: Benefits and Risks/Harms of Implementation

T1DM: Benefits and Risks/Harms of Implementation (2024)

Various factors should be considered prior to implementation of recommendations. Every recommendation statement includes benefits and risks/harms specific to that recommendation. Access the recommendations from the **Guideline Recommendations and Supporting Evidence** tab.

When using these recommendations, please consider the following:

- The primary goal of implementing these recommendations is improving client outcomes while individualizing care to your clients' preferences and health status.
- Although costs of Medical Nutrition Therapy (MNT) sessions and reimbursement vary, MNT is essential for improved outcomes.
- MNT can be considered cost-effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities vs cost of the interventions.

Please consider the following when determining the best methods of implementing recommendations:

- Client's age, socio-economic status, cultural membership, psychological and mental health status, health history and other individual and health conditions.
- Use clinical judgment in determining the appropriateness of each recommendation for each client.
- The Academy has developed a new resource which aims to assist nutrition and dietetics practitioners with implementing evidence-based practice recommendations and clinical practice innovations into daily practice. Click to download [Implementing Evidence: from Guidelines to Daily Practice](#).

Disclaimer

Academy of Nutrition and Dietetics Evidence-based Nutrition Practice Guidelines are intended to serve as a synthesis of the best evidence available to inform registered dietitian nutritionists as they individualize nutrition care for their clients. Guidelines are provided with the express understanding that they do not establish or specify particular standards of care, whether legal, medical or other.

Evidence-based Nutrition Practice Guidelines are intended to summarize the best available research as a decision tool for Academy members.

No endorsement by the Academy of Nutrition and Dietetics of any brand-name product or service is intended or should be inferred from a Guideline or from any of its components (including Questions, Evidence Summary, Conclusion Statement, Conclusion Statement Grade, Recommendation or Recommendation Rating).

Proceed to Dissemination and Implementation

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jQuery("#sort_list_4938>a").click();T1DM: Dissemination and Implementation of Guideline

T1DM: Dissemination and Implementation of Guideline (2024)

Dissemination and implementation of guidelines is very important for the Academy. Dissemination focuses on spreading the knowledge and information of these guidelines via various means. Implementation, on the other hand, involves integration of the evidence-based interventions into practice, and examining barriers and facilitators that can influence the effectiveness of these evidence-based recommendations.

Guideline Dissemination

The publication of this EBNPG is an integral aspect of the plans for disseminating the Academy of Nutrition and Dietetics Type 1 Diabetes (Pediatrics) 2024 Evidence-Based Nutrition Practice Guideline to all dietetics practitioners engaged in, teaching, or researching T1DM. Additionally, there are recommended dissemination and adoption strategies for local use of the Academy's T1DM Evidence-Based Nutrition Practice Guideline.

Dissemination of the T1DM EBNPG will be achieved by announcement at professional events, on social media, available on the Evidence Analysis Library website and published in a professional journal, as well as various presentations. Some strategies include:

- National and local events: State dietetic association meetings and media coverage will help launch the EBNPG.
- Local feedback adaptation: Presentation by members of the work group at peer review meetings and opportunities for CEUs for courses will be provided
- Education initiatives: The EBNPG and supplementary resources will be freely available for use in the education and training of dietetic interns and students in approved Accreditation Council for Education in Nutrition and Dietetics (ACEND) programs
- Champions: Local champions will be identified, and expert members of the expert panel will prepare articles for publication. Resources will be provided that include PowerPoint presentations.

Specific distribution strategies include:

- Publication in full: The EBNPG is available electronically at the Academy Evidence Analysis Library website (www.andeal.org) and will be announced to all the dietetic practice groups. The Academy Evidence Analysis Library will also provide downloadable supporting information.
- Scientific publication: The EBNPG will be published in the *Journal of the Academy and Nutrition and Dietetics* (issue to be determined).
- Presentations: Results from the EBNPG were presented at the FNCE 2024 - *Providing MNT for the Pediatric Type 1 Diabetes Population: What Does the Evidence Show?*
- Type 1 Diabetes Pediatrics (2024) Guideline Presentation - includes all the recommendations and ratings of the EBNPG in a PowerPoint presentation format. Ideal for in-service presentations, staff training sessions and classes (not designed for patient or client use). [Download for free.](#)

Guideline Implementation

- Please see the "Considerations for Application" section of the guideline recommendations for tools and expert advice regarding how to implement the recommendations.
- The Academy's Council on Research Implementation Subcommittee developed *Implementing Evidence: from Guidelines to Daily Practice* to assist nutrition and dietetics practitioners with implementing evidence-based practice recommendations and clinical practice innovations into daily practice. ([PDF](#)).
- Practitioner Guide: Guideline Flowchart ([PDF](#)).
- Practitioner Guide: T1DM Medical Nutrition Therapy Recommendations ([PDF](#))

Monitoring, Evaluating and Auditing Guideline

Practitioners are encouraged to monitor and evaluate the effectiveness of EBNPG. The Academy of Nutrition and Dietetics offers members the opportunity to document outcomes on their online platform [ANDHII](#), and/or join the [Nutrition Research Network](#) for inclusion in research studies such as those that evaluate the effectiveness of EBNPG.

To evaluate the effectiveness of evidence-based nutrition practice guidelines, dietitians and other health care practitioners are encouraged to utilize strategies promoted within the field of implementation science. These include but are not limited to:

- Assessment of the guideline (clarity, quality, acceptability, complexity, sustainability).
- Prioritize implementation of 1–2 recommendations based on assessment of the guideline.
- Form an implementation team.
- Develop an implementation plan with identification of barriers and strategies:
 - Develop an evaluation plan.
 - Identify measurable implementation as well as health outcomes.
 - Utilize Nutrition Research Network Resources.
 - Utilize the Academy's ANDHII data collection platform.

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