Medical Nutrition Therapy for Youth with Type 1 Diabetes Mellitus: More than Carbohydrate Counting

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NANSEL AND COLLEAGUES[1] HAVE CHALLENGED US to broaden how we evaluate food intake in medical nutrition therapy (MNT) for youth with type 1 diabetes mellitus. Their cross-sectional study examined how 3-day diet-record data were related to clinical and demographic data extracted from medical records. Poorer Healthy Eating Index[2] scores were associated with higher body mass index (BMI). Research findings from the Centers for Disease Control and Prevention indicate that the adult population in the United States failed to achieve the American Heart Association metric for a healthy dietary pattern,[3,4] which suggests MNT provides health benefits for the whole family.

The Nansel and colleagues[1] data revealed that their adolescent patients with type 1 diabetes mellitus did not consume the recommended amounts of more healthful carbohydrates. Intake of fruits, vegetables, and whole grains was less than half the amount recommended, with most of their carbohydrate intake coming from highly processed food items, such as refined grains, desserts, and chips. The adolescents with a higher intake of fruits and whole grains had a lower BMI percentile than those with a lower intake of these food groups. However, Nansel and colleagues[1] did not address many issues that could be explored with their dietary and clinical data. Their data analysis focused on fruit, vegetable, and whole-grain intake and did not address the fat content of the dairy consumed, which makes it difficult to determine which foods were the primary contributors to the reported ~12% of total energy intake from saturated fat. The American Diabetes Association has recommended limiting intake of saturated fat to <7% of total caloric intake to reduce the risk for cardiovascular complications.[5] Data from the Diabetes Control and Complications Trial (DCCT) and the follow-up study known as Epidemiology of Diabetes Interventions and Complications have indicated that higher intake of saturated fat predicts greater insulin resistance as well as higher level of low-density lipoprotein cholesterol in type 1 diabetes mellitus.[6]

Our editorial examines the deeper implications of their findings and suggests counseling strategies for addressing dietary quality as part of diabetes MNT focusing on general health and other cardiovascular risk targets, such as weight, lipid levels, and blood pressure, in addition to glycemic control goals. Of particular concern is the finding that <1% of their participants had a dietary intake rated as "good" on the Health Eating Index. This finding raises questions about how dietary quality affects the risk of diabetes complications resulting from weight-related health conditions, such as hypertension and dyslipidemia. However, diet quality was not related to hemoglobin A1c (HbA1c) level after adjusting for demographic and clinical variables associated with poorer glycemic control. Findings from the DCCT indicated that management of excessive weight gain among individuals with type 1 diabetes mellitus was a result of decreased glucosuria, not increased energy intake in the intensified treatment condition.[6] The registered dietitians (RDs) addressed how intensive therapy altered energy balance and taught DCCT participants how to adjust caloric intake to compensate for the decreased urinary glucose loss and thereby minimize long-term weight gain.[7] However, the DCCT participants who gained the most weight over time also had changes in lipid levels and blood pressure similar to the biometric changes associated with insulin resistance, which is common in type 2 diabetes and linked to increased risk of coronary artery disease.[8] In the DCCT, adhering to the prescribed meal plan (eg, consistency of meal time and composition to simplify calibrating insulin boluses for meal or adjusting food and/or insulin in response to hyperglycemia) was associated with lower HbA1c levels.[6] Conversely, overtreating hypoglycemia and consuming extra snacks beyond the meal plan were associated with higher HbA1c levels.

The current standards of care for type 1 diabetes mellitus, which includes self-monitoring of blood glucose four or more times daily and multiple daily insulin injections or subcutaneous insulin infusion pump therapy, is consistent with the DCCT protocol for intensive therapy. Despite receiving standard of care treatment with respect to self-monitoring and insulin therapy, the mean HbA1c level of the youth in this study was 8.5%. (Note: Although the HbA1c goal for adults is <7%, the goal for children ages 6 to

12 years is <8% or <7.5%, if achievable without excessive hypoglycemia. For adolescents the goal is <7.5% or <7% if achievable without excessive hypoglycemia.[9]) The Nansel and colleagues[1] study provided few insights into specific MNT strategies for achieving glycemic control. Although higher intake of fruits and whole grains was associated with low HbA1c levels, this association was no longer significant after adjusting for age, Tanner stage for sexual maturation, insulin regimen, and frequency of blood-glucose monitoring. Although Nansel and colleagues[1] noted that the insulin regimen (multiple daily injections vs pump) was not related to the HbA1c level, their study did not address how the variables that predicted higher HbA1c levels in the DCCT, such as overtreating hypoglycemia and eating extra snacks, were related to the HbA1c level.

Exploring how dietary intake among youth with diabetes compares to their peers might provide insights for improving the quality of their food intake and weight-related health issues. Nansel and colleagues[1] noted that their type 1 diabetes mellitus study participants consumed almost half of their energy intake from refined foods and ate less fruits and vegetables than the national average. Within the refined-food group, desserts and chips were the largest contributor to energy intake, accounting for >25% of total kilocalories. Although beverages only accounted for about 1% of total energy intake, no estimates were provided for sugar-sweetened beverages (SSB) per se. Presumably, SSB intake was quite low, contributing an average of 20 kcal/day. While the youth with type 1 diabetes mellitus behaved like their peers, with excess body weight being associated with low-quality food choices, their low intake of SSBs differs substantially from the average intake of teens.[10,11]

Cross-sectional data from the Third National Health and Nutrition Examination Survey indicated that central adiposity was inversely associated with intake of dairy, grains, and total fruits and vegetables.[10] In the National Growth and Health Study, adolescent girls whose diets more closely resembled the Dietary Approaches to Stop Hypertension eating pattern at age 9 to 10 years, had smaller gains in BMI during the subsequent 10 years than their peers with poorer dietary intake.[11] The preadolescent girls in the highest vs lowest quintile of the Dietary Approaches to Stop Hypertension score had a mean BMI of 24.4 vs 26.3 at 19 years of age, after adjusting for demographic variables, sedentary behavior, physical activity, and other dietary elements.[11] The strongest individual food-group predictors of BMI were total fruit (mean BMI 26.0 vs 23.6 for <1 vs ≥2 servings per day; $P<0.001$) and low-fat dairy (mean BMI 25.7 vs 23.2 for <1 vs ≥2 servings per day).

Although the Dietary Approaches to Stop Hypertension dietary pattern is associated with maintaining a healthier body weight, adjustments might be needed to estimate insulin needs for youth with type 1 diabetes mellitus. Addressing synchronization of insulin therapy with carbohydrate intake is integral to type 1 diabetes mellitus MNT. Meal planning usually involves estimating carbohydrate intake. Therefore, higher-carbohydrate vegetables, such as potatoes, corn, and peas, are grouped with starches in the diabetes food-exchange system and in simplified carbohydrate counting. Another component of MNT in relation to insulin therapy is consideration of carbohydrate choices in relation to sports or other physical activities.

Analysis of cross-sectional data from the SEARCH study, an ongoing multicenter study of diabetes risk in youth, revealed a paradoxical relationship between beverage choice and glycemic control in type 1 diabetes mellitus.[12] Although half of the youth with type 1 diabetes mellitus did not consume any SSB, greater SSB intake was associated with higher participation in team sports, presumably related to use of sport drinks. Therefore, it is not surprising that after adjusting for sociodemographic and clinical covariates, physical activity, and total energy intake, consumption of SSB (at least one serving per day vs none) was associated with higher levels of total cholesterol, low-density lipoprotein cholesterol, and plasma triglycerides, but not with HbA1c. High consumption of diet beverages was associated with higher HbA1c, total cholesterol, low-density lipoprotein cholesterol, and triglycerides, although BMI, saturated fat, and total fiber intake were confounders. SSB intake might have an adverse effect on cardiovascular risk in youth with type 1 diabetes mellitus, although diet beverage intake might be a marker of an unhealthy lifestyle and concomitant poor metabolic control.[12]

Carbohydrate counting is often considered to be the most straightforward strategy for calibrating the bolus insulin dose for meals and snacks in the management of type 1 diabetes mellitus.[13] However, overall nutrition quality should not be neglected in MNT for youth with type 1 diabetes mellitus. A study examining the intake of SSB among adolescents and its impact on weight status found that although there was no effect of SSB on weight status, attitudes accompanying intake of SSB can include a total lack of concern for weight-related food choices.[14] Other barriers observed include perceived difficulty and effort in weight control, cost, lack of skills, time constraints, and difficulty overcoming feelings of deprivation.

RDs can offer an individualized nutrition-counseling approach based on the principles of motivational interviewing, with emphasis on behavior counseling or coaching; this approach includes assessing dietary intake from the perspective of patients, which provides insights about barriers to achieving the recommended levels of foods such as fruits, vegetables, and whole grains.[15] The assessment can also provide important insights about where and when the adolescents are eating; how the home, school, and community environment influence food intake; knowledge, attitudes, and beliefs about the role of nutrition in diabetes management; and self-assessment by the teens about how their lifestyle (eg, food intake, physical activity, insulin regimen) might be related to their glucose monitoring or HbA1c results. In addition, RDs can integrate an evidence-based behavior-change approach into MNT, focusing on intrinsic motivators.[15]

Understanding the perspective of the patient/client allows the RD to tailor MNT content to address needs and readiness for optimal success. The Figure has examples of open-ended questions that elicit attitudes and levels of self-efficacy related to food intake among individuals with type 1 diabetes mellitus. MNT can help prevent and control diabetes complications.[16-19] RDs need to address risks associated with excess body weight in MNT for youth with type 1 diabetes mellitus. The assessment phase for MNT should address a wide variety of lifestyle factors that affect long-term risk of complications in youth with type 1 diabetes mellitus. Unlike the majority of

How do you manage your diabetes?
How does diabetes affect your day's schedule or routine?
How does diabetes affect your food intake?
What foods and beverages do you have when you are at school?
What are some foods or beverages you choose or stay away from because you have diabetes?
How do social situations affect what you eat or drink?
How does physical activity affect what you eat or drink?
What are your goals with regard to diabetes?
What would you like to know to make managing your diabetes easier?
What role(s) do your [friends, family, coach, school nurse] play in managing your diabetes, eg, helping you manage hypoglycemia?
What is your hemoglobin A1c goal?

Figure. Open-ended questions to elicit information about diabetes and food intake.

youth, SSB intake was low in youth with type 1 diabetes mellitus. However, other refined foods comprised almost half of their energy intake, which could be associated with low intake of some micronutrients.

Although refined grains are fortified with folic acid and enriched with thiamin and riboflavin, whole grains have trace elements, such as magnesium and panothenic acid, which also play critical roles in the tricarboxylic acid cycle of intermediary metabolism. Although micronutrients are essential for intermediary metabolism and utilization of glucose for energy, current evidence does not warrant specific micronutrient supplementation to prevent development of diabetes or its complications. Guidance about vitamin or mineral supplementation should be based on nutritional status for people with diabetes, just as it is for the general population. The American Diabetes Association recommends nutrient-rich fruits and vegetables, but does not recommend routine supplementation with antioxidants, such as vitamins E and C and carotene, because of lack of efficacy and concern related to long-term safety.[5]

As Nansel and colleagues[1] noted, there is a surprising dearth of research examining the nutritional quality of diets in children with type 1 diabetes mellitus. Future research goals should include strengthening the pool of existing data on diet quality, examining the effects of food type (eg, processed vs nonprocessed), and developing and evaluating intervention strategies for improving dietary intake. Project EAT (Eating Among Teens) found that home availability of unhealthy food was inversely associated with vegetable and fruit and starchy food patterns and positively associated with fast-food and snack-food patterns.[20] Parental and peer support for healthy eating were both positively associated with the vegetable and fruit pattern and inversely associated with the fast-food pattern. RDs can address the support network to improve the dietary quality of habitual eating practices in adolescents by encouraging parents to decrease home availability of unhealthy food, while increasing the availability of healthy food, family-meal frequency, and parental support for healthy eating. In addition, youth with type I diabetes mellitus are at increased risk of chronic disease comorbidities, and risk factors attained during childhood, adolescence, or early adulthood can represent an early warning system for future risk of developing cardiovascular complications.[21] MNT provides a venue for improving glycemic, blood pressure, and lipid parameters in order to reduce the risk of end-organ damage affecting multiple body systems. The American Diabetes Association has recommended that all individuals with prediabetes and diabetes receive MNT provided by an RD, but these recommendations do not focus on the needs of children per se.[5] Increasing research and awareness about the role of diet quality in the management of type 1 diabetes mellitus can reduce complications and facilitate developing stronger evidence-based guidelines and policies.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

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