Dietary management of gestational diabetes: the ethics of balancing fetal outcomes with maternal psychological and metabolic health

Raleigh, North Carolina

by

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Abbreviations

ADA: American Diabetes Association
AND: Academy of Nutrition and Dietetics
BMI: Body mass index
CDAPP: California Diabetes and Pregnancy Program
CHO: Carbohydrate
DRI: Daily reference intake
GDM: Gestational diabetes mellitus
GI: Glycemic index
LGA: Large for gestational age
MNT: Medical nutrition therapy
NHANES: National Health and Nutrition Examination Survey
PPD: Postpartum depression
RDN: Registered dietitian nutritionist
SMBG: Self-monitoring of blood glucose
T2DM: Type 2 diabetes mellitus
**Introduction**

Gestational diabetes mellitus (GDM) is defined by the American Diabetes Association (ADA) as “diabetes diagnosed in the second or third trimester of pregnancy that was not clearly overt diabetes prior to gestation.”\(^1\) According to the Centers for Disease Control Pregnancy Risk Assessment Monitoring System, the estimated prevalence of GDM in the United States was between 4.6 and 9.2% of live births in 2010.\(^2\) 2007-2014 data from the National Health and Nutrition Examination Survey (NHANES) show an estimated prevalence of 7.6%.\(^3\) Risk factors for GDM include body mass index (BMI) >25, less than recommended weight gain during pregnancy, maternal age over 25 years old, 1st degree family history of diabetes, higher parity (3 or more live births), previous pregnancy with GDM, or belonging to an ethnic group with increased risk for type 2 diabetes mellitus (T2DM) (Hispanic, Native American, South or East Asian, African American, or Pacific Islands descent).\(^3-5\) In essence, the majority of pregnant women have at least one risk factor for GDM. Factors that lower the risk of GDM include the inverse of these variables (BMI < 25, maternal age < 25 years, no family history of diabetes, no previous pregnancies with GDM, white race), in addition to lifestyle factors prior to pregnancy such as not smoking, participating in 150 minutes or more of physical activity per week, and consuming a healthy diet.\(^5,6\)

GDM poses significant health risks to the mother and the child. Women with GDM are more likely to experience preeclampsia and cesarean delivery, and their infants are more likely to have macrosomia, large for gestational age (LGA), neonatal hypoglycemia, intensive neonatal care, premature delivery, hyperbilirubinemia, high cord blood serum c-peptide, shoulder dystocia or birth injury, and even experience
perinatal mortality.\textsuperscript{7–10} The relationship between maternal blood glucose and neonatal adiposity is positive and linear; the risk for birth complications and shoulder dystocia - more common among macrosomic/LGA infants - can be attenuated with blood glucose management during pregnancy.\textsuperscript{7} NHANES data estimates that 19.7\% of women with GDM will later develop T2DM; other data show that this rate is 7-fold greater among women who have had GDM compared to women who had normoglycemic pregnancies.\textsuperscript{3,11} For women of racial/ethnic minority groups, particularly black women, the risk of T2DM after GDM is elevated further even after controlling for differences in BMI.\textsuperscript{12}

Women who experience GDM are also at increased risk of metabolic syndrome and cardiovascular events.\textsuperscript{13,14} Research on long-term metabolic health of children born during a GDM pregnancy is unclear. Some data suggest an increased risk for obesity later in childhood or adulthood among women with GDM, but there is also conflicting research attributing the risk of childhood obesity to high maternal BMI rather than intrauterine exposure to GDM.\textsuperscript{15–20} Similar observations have been made about risk for T2DM and metabolic syndrome in children of women with GDM – in-utero exposure to diabetes poses risk for offspring, but maternal pre-gravid BMI may be a higher risk factor for metabolic dysfunction than GDM.\textsuperscript{16,21,22}

In addition to metabolic risk factors, women with GDM are known to experience high levels of psychological distress.\textsuperscript{23,24} Although women with GDM may adapt well psychologically to their diagnosis, this stress can impact their ability to comply with self-management behaviors and predispose them to postpartum depression (PPD).\textsuperscript{25–28} Further complicating health risks for women with GDM is a shift in focus from maternal
health to solely fetal outcomes, which is contributing to an increase in maternal mortality in the US overall.\textsuperscript{29,30}

Despite these risks, dietary and lifestyle management of GDM shows promise in mitigating negative implications for birth outcomes as well as for long-term metabolic health of mother and child.\textsuperscript{7,31–34} In July 2018, the Academy of Nutrition and Dietetics (AND) came out with an update to their evidence-based nutrition practice guidelines for GDM, in which they review the role of the registered dietitian nutritionist (RDN) in providing medical nutrition therapy (MNT) to women with GDM.\textsuperscript{35} The AND practice paper reviews various dietary regimens for managing blood glucose in pregnancy, including the highly successful strategies proposed by the research group of Dr. Lois Jovanovic and implemented by the California Diabetes and Pregnancy Program (CDAPP).\textsuperscript{36} Of course, other recommendations exist from a variety of sources; one such alternative method is proposed by a registered dietitian who has extensive experience working with prenatal clients.\textsuperscript{37} Finding the optimal dietary treatment strategy for a client with GDM requires that the RDN be able to both understand the pathophysiology of GDM and integrate the knowledge of the metabolic effects of GDM with the many psychosocial factors that impact women with high risk pregnancies in the United States. The purpose of the present paper is to explore the RDN’s role in balancing optimization of short-term pregnancy outcomes with long-term maternal metabolic and mental health outcomes in dietary management of GDM.
Pathophysiology and diagnosis of GDM

Some amount of peripheral insulin resistance is expected in normal pregnancy, which functions to increase nutrient transfer to the fetus. Insulin sensitivity in normal pregnancy has been shown to be negatively correlated with serum levels of placental growth hormone, but lower insulin sensitivity has recently been shown to be more strongly correlated with both increased fasting triglycerides and leptin and positively correlated with increased insulin-like growth factor binding protein-1. Interestingly, when controlling for fasting levels of adipokines in their model, McIntyre et al. found that the relationship between maternal BMI and insulin resistance was no longer found to be statistically significant – following the logic of the relationship they found between insulin resistance and leptin, this is likely because the majority of maternal leptin is produced by the placenta and not by adipose tissue. However, differences in placental leptin receptors are present between obese and non-obese women, which may still contribute to higher insulin resistance and risk for GDM in obese women. Adiponectin may also play a role – in non-obese women, as well as when controlling for adiposity and baseline glucose tolerance, pregnant women with low levels of adiponectin in their first trimester were found to have higher insulin resistance and be at increased risk of GDM later in pregnancy.

Just like any other form of diabetes, GDM is a condition of hyperglycemia that results from a combination of insulin resistance and an inability for pancreatic beta-cells to compensate for the body’s insulin needs. As the body becomes more resistant to insulin in natural pregnancy progression, insulin requirements to maintain euglycemia are elevated; studies show further increases in insulin resistance and lower insulin output
when comparing women with GDM to women without GDM both before pregnancy and during the third trimester.\textsuperscript{45–47} While GDM may be an acquired disorder only in pregnancy for some women, the fact that many women with GDM show lower serum insulin before pregnancy indicates they likely have pre-existing beta-cell dysfunction, which is simply discovered upon screening during pregnancy.\textsuperscript{48} As expressed above, the ADA defines GDM as a distinct disorder during pregnancy that is not pre-existing Type 1 diabetes mellitus (T1DM) or T2DM.\textsuperscript{1} However, studies among women with GDM show relative prevalence of autoimmune, monogenic, and type-2-like diabetes that reflect the prevalence of evolving T1DM, mature-onset diabetes of the young, and prediabetes/T2DM in the population as a whole.\textsuperscript{48}

The diagnosis of GDM is a debated topic, with different diagnostic criteria proposed by different expert organizations.\textsuperscript{1} In general, recommendations are to screen women prior to conception or at the first prenatal visit for undiagnosed T1DM or T2DM, and initiate blood glucose management with these women immediately.\textsuperscript{1,49} If there is no overt pregestational diabetes, either the one-step or the two-step method is used to diagnose GDM at 24-28 weeks of pregnancy, when insulin resistance is at its highest.\textsuperscript{1}

One-step strategy: perform a 75 g oral glucose tolerance test (OGTT) after an 8 hour fast at 24–28 weeks of gestation in women not previously diagnosed with overt diabetes. The diagnosis of GDM is made when any of the following plasma glucose values are met or exceeded at fasting, 1 hour, or two hours (see Table 1).\textsuperscript{1}

Two-step strategy: Step 1 is to perform a 50-g glucose loading test in a non-fasting state at 24–28 weeks of gestation in women not previously diagnosed with overt diabetes. If the plasma glucose level measured 1 h after the load is 130 - 140 mg/dL,
proceed to Step 2. In step 2, perform a 100-g OGTT when the patient is fasting. The diagnosis of GDM is made if one of the following plasma glucose levels are met or exceeded at 1 hour, 2 hours, or 3 hours (see Table 1).

Table 1. Diagnostic criteria for GDM

<table>
<thead>
<tr>
<th></th>
<th>One-Step</th>
<th>Carpenter-Coustan</th>
<th>OR</th>
<th>National Diabetes Data Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fasting</strong></td>
<td>92 mg/dL</td>
<td>95 mg/dL</td>
<td>105 mg/dL</td>
<td></td>
</tr>
<tr>
<td><strong>1 h</strong></td>
<td>180 mg/dL</td>
<td>180 mg/dL</td>
<td>190 mg/dL</td>
<td></td>
</tr>
<tr>
<td><strong>2 h</strong></td>
<td>153 mg/dL</td>
<td>155 mg/dL</td>
<td>165 mg/dL</td>
<td></td>
</tr>
<tr>
<td><strong>3 h</strong></td>
<td>140 mg/dL</td>
<td></td>
<td>145 mg/dL</td>
<td></td>
</tr>
</tbody>
</table>

The ADA does not take a clear stance on which GDM screening criteria should be used, but suggests with adequate prenatal care, the 1-step method may be the most beneficial and cost-effective. Some other research suggests that an A1c of >5.7%, which is indicative of pre-gestational prediabetes, may be particularly useful in identifying more women with mild GDM who would benefit from treatment. Depending on the etiology of her GDM and other biological factors, each woman’s specific response to dietary carbohydrates may vary. Results from studies using continuous glucose monitoring systems show elevated post-breakfast morning blood glucose – consistent with higher insulin resistance in the morning in diabetes outside of pregnancy, commonly known as the dawn phenomenon – as well as impaired early-
phase insulin secretion leading to higher postprandial blood glucose compared to non-diabetic pregnant women.\textsuperscript{53,54}

Fructose is a common culprit for causing or worsening T2DM. As will be discussed in the next section, fructose from fruit and added sugar are often suggested to be limited in MNT strategies for GDM, particularly at breakfast.\textsuperscript{36} In glycolysis, the rate-limiting step is the conversion of fructose-6-phosphate to fructose-1,6-bisphosphate by phosphofructokinase – dietary fructose bypasses this step and is metabolized by fructokinase into fructose-1-phosphate, leading to more rapid production of the metabolites glyceraldehyde and dihydroxyacetone-phosphate than when glucose is metabolized.\textsuperscript{55} This is a basic pathway in general human nutritional biochemistry, but is important to note in considering the potential effectiveness of the dietary management strategies outlined in this paper.

**Efficacy of dietary management strategies for GDM**

“Success” in GDM blood glucose management is defined by consistently meeting blood glucose targets for GDM as outlined by the ADA in the table below.\textsuperscript{49} However, there is some debate as to whether these targets are low enough to prevent risks associated with GDM. A 2011 systematic review found evidence to suggest lower fasting blood glucose targets, and called for further trials to be conducted on optimal postprandial targets.\textsuperscript{56} The CDAPP also uses targets lower than suggested by the ADA, and guides practitioners to not use 2 hr postprandial blood glucose targets, as post-meal glycemic peaks occur on average at 1 hr after beginning a meal and are most closely correlated with poor fetal outcomes.\textsuperscript{36} These targets are compared in Table 2.
Table 2. Comparison of blood glucose targets for GDM\textsuperscript{36,49,56}

<table>
<thead>
<tr>
<th></th>
<th>ADA 2018</th>
<th>Hernandez et al. 2011*</th>
<th>CDAPP 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fasting</strong></td>
<td>&lt; 95 mg/dL</td>
<td>&lt; 81 mg/dL</td>
<td>&lt;90 mg/dL</td>
</tr>
<tr>
<td><strong>Premeal/bedtime/overnight</strong></td>
<td></td>
<td></td>
<td>60-99 mg/dL</td>
</tr>
<tr>
<td><strong>Postprandial, 1-hr</strong></td>
<td>&lt; 140 mg/dL</td>
<td>&lt;122 mg/dL</td>
<td>100-129 mg/dL</td>
</tr>
<tr>
<td><strong>Postprandial, 2-hr</strong></td>
<td>&lt; 230 mg/dL</td>
<td>&lt;110 mg/dL</td>
<td></td>
</tr>
<tr>
<td><strong>Mean daily glucose</strong></td>
<td></td>
<td></td>
<td>87-100 mg/dL</td>
</tr>
</tbody>
</table>

*based on mean blood glucose measurements seen in normal pregnancies

The AND endorses the 2016 ADA guidelines (this current paper references the 2018 ADA guidelines, but recommended blood glucose targets have not changed), as these are backed by the Fifth International Workshop-Conference on Gestational Diabetes Mellitus.\textsuperscript{57} Given that there is a lack of consensus in diagnostic criteria and blood glucose targets after diagnosis, it is no surprise that researchers and clinicians promote a wide variety of dietary approaches for optimal blood glucose management in GDM.

**AND Evidence Based Nutrition Practice Guidelines for GDM**

The AND practice paper is a systematic review covering several key questions determined by an expert panel of GDM nutrition practitioners and researchers.\textsuperscript{35} The structure of the paper follows the Nutrition Care Process (assessment, diagnosis, intervention, monitoring and evaluation), making it simple for an RDN to apply in practice. As expected for a paper coming from the professional organization for RDNs, their very first recommendation is to refer all women diagnosed with GDM to an RDN for MNT, a guideline that is supported by both the ADA and the Endocrine Society.\textsuperscript{49,58} The
panel then endorses that an RDN complete each specific step of the Nutrition Care Process with every GDM client they are referred – this is simply a standard of clinical practice for every patient seen by an RDN, but nonetheless it is important to advocate that a qualified nutrition provider be involved in each of these steps when caring for a woman with GDM.

The practice paper proceeds to then analyze the evidence for different dietary recommendations, ascribing an evidence rating (strong, fair, weak, consensus, or insufficient evidence) to each dietary strategy. Table 3 shows a breakdown of strategies that received each rating, with a brief description of what each rating means. There were no recommendations deemed to be “weak” or have “insufficient evidence.”
Table 3. Ratings for specific recommendations from the AND\textsuperscript{35,59}

<table>
<thead>
<tr>
<th>Rating</th>
<th>Recommendations pertaining to women with GDM</th>
</tr>
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<tbody>
<tr>
<td><strong>Strong –</strong></td>
<td>Practitioners should follow the recommendation</td>
</tr>
<tr>
<td></td>
<td>Refer to an RDN for MNT.</td>
</tr>
<tr>
<td></td>
<td>RDNs should implement MNT for GDM.</td>
</tr>
<tr>
<td></td>
<td>Encourage physical activity for at least 30 minutes every day, unless contraindicated.</td>
</tr>
<tr>
<td><strong>Fair –</strong></td>
<td>Practitioners should generally follow the recommendation, but remain alert for new information and be sensitive to patient preferences</td>
</tr>
<tr>
<td></td>
<td>RDNs should individualize kcal prescriptions based on daily reference intakes (DRI) and Institute of Medicine guidelines.</td>
</tr>
<tr>
<td></td>
<td>RDNs should individualize the amount and type of carbohydrate (CHO) for women with GDM – not enough evidence exists for a specific CHO goal for all women with GDM; low to medium glycemic index (GI) diets (&lt;55-99) and DASH diets show positive outcomes.</td>
</tr>
<tr>
<td></td>
<td>RDNs should individualize amount and type of CHO at breakfast – shifts to lower CHO or lower GI breakfasts may help some women; no studies support restricting individual foods like fruit or milk at breakfast.</td>
</tr>
<tr>
<td><strong>Consensus</strong> – expert opinion</td>
<td>RDNs should complete assessments including anthropometric, biochemical, and medical data as well as nutrition-focused physical findings and client history for women with GDM.</td>
</tr>
<tr>
<td>---</td>
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<tr>
<td>supports the guideline despite inconsistent results or lack of controlled trials in the literature;</td>
<td>RDNs should provide regular and frequent MNT visits – 1 initial 60-90 minute visit, a 30-45 minute follow-up within 1 week, another 15-45 minute follow up within 2-3 weeks, and additional follow-ups as needed or until the end of the pregnancy.</td>
</tr>
<tr>
<td>practitioners should be flexible and patient preference should have significant influence</td>
<td>RDNs should provide adequate macronutrients to support pregnancy based on nutrition assessment and with guidance from the DRIs: minimum 175 g CHO, minimum 71 g protein (1.1g/kg/d), and 28 g fiber.</td>
</tr>
<tr>
<td></td>
<td>RDNs should encourage adequate vitamin and mineral intake through healthy food choices, with emphasis on iron, folate, calcium, vitamin D, choline, and iodine.</td>
</tr>
<tr>
<td></td>
<td>RDNs should recommend daily use of a prenatal multivitamin/multimineral supplement to meet the DRIs for pregnancy, and any additional supplements to address inadequate intake or micronutrient deficiency.</td>
</tr>
<tr>
<td></td>
<td>RDNs should distribute total kcals and CHO into smaller meals and snacks throughout the day – 3 meals and 2 snacks may help, but distribution should be individualized.</td>
</tr>
</tbody>
</table>
RDNs should guide women with GDM who choose to use artificial sweeteners to choose only those approved by the FDA or generally recognized as safe (saccharin, aspartame, acesulfame potassium, sucralose, neotame, advantame, steviol glycosides, and monk fruit extract).

RDNs should reinforce abstinence from alcohol during pregnancy.

RDNs should monitor and evaluate food and nutrition-related history outcomes, anthropometric measurement outcomes, and biochemical data, medical tests, and procedure outcomes including self-monitoring of blood glucose (SMBG) records and ketone testing records.

As evidenced by the recommendations in the table above, the AND working group found mixed evidence for specific dietary recommendations beyond traditional nutrition recommendations for pregnancy. Their synthesis points practitioners towards individualization based on patient assessment, monitoring, and preference, and conclude that “more information is needed to determine optimal calorie levels, amount and types of macronutrients, and distribution of meals and snacks for optimal clinical outcomes for both mothers with GDM and their infants.”\(^{35}\)
CDAPP and Jovanovic/Euglycemic Diet Recommendations for GDM

The CDAPP is a program for all women with diabetes in pregnancy developed through the California Department of Public Health, and is greatly influenced by the endocrinologist and diabetes in pregnancy researcher, Dr. Lois Jovanovic. Because most of Dr. Jovanovic’s nutrition research papers were published before the year 2000, they were excluded during the AND’s systematic review, except for one paper which reviews fasting blood glucose in early pregnancy for women with diabetes.

The Jovanovic or Euglycemic diet for GDM is low GI, and fairly low carbohydrate diet – overall 40% CHO, 20% protein, 20% fat. It also includes specific macronutrient recommendations for meals (Table 4.)

Table 4. Jovanovic/Euglycemic Diet Carbohydrate Percentage by Meal

<table>
<thead>
<tr>
<th>Target postprandial blood glucose</th>
<th>&lt;140 mg/dL</th>
<th>&lt;120 mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>&lt;45%</td>
<td>&lt;33%</td>
</tr>
<tr>
<td>Lunch</td>
<td>&lt;55%</td>
<td>&lt;45%</td>
</tr>
<tr>
<td>Dinner</td>
<td>&lt;50%</td>
<td>&lt;40%</td>
</tr>
</tbody>
</table>

The Jovanovic/Euglycemic diet is the basis of the CDAPP, and is also implemented at the Sansum Diabetes Research Center in Santa Barbara, CA. In North Carolina, Dr. Edith Miller, an endocrinologist who worked closely with Dr. Jovanovic and is now medical director of the Carolinas Diabetes Center, oversees its implementation through
the meals served to hospitalized obstetric patients with GDM at Atrium Health and in the MNT provided to women with GDM at the Carolina Diabetes Center in Charlotte, NC.

The CDAPP guides RDNs to provide meal plans to clients with GDM that have a minimum of 175 g CHO per day, as this is the DRI for pregnancy, and less than 45% kcals from CHO, distributed between 3 meals and 2 to 4 snacks with a lower CHO breakfast (15-30 g). The guidelines emphasize a low GI diet, and recommend excluding fruit juices, fruits, milk, ready-to-eat or instant cereals, bagels, croissants and rice porridge from breakfast. Snacks are to contain a lower amount of carbohydrate than lunch and dinner and should occur 2-3 hours after or before a meal; snacks should not contain both fruit and milk. Bedtime snacks with 7 g of protein and 15-30 g CHO are recommended no more than 10 hours before breakfast the following morning to prevent middle-of-the-night hypoglycemia, starvation ketosis, and to suppress hepatic glucose output in response to low blood glucose. RDNs should tailor their approach to the client, and may use carbohydrate counting methods, or visuals such as the California MyPlate for Gestational Diabetes.

There is no reference provided in the CDAPP guidelines for why fruits or milk should be excluded at breakfast. In observation of nutrition counselling at the Carolinas Diabetes Center, the registered dietitians claimed that in practice the avoidance of fruit at breakfast seemed to drastically help postprandial blood glucose in the morning but were unsure why this worked. While the AND found no evidence that fruit or milk should be excluded at breakfast, theoretically it is possible that the fructose content of fruit, and in other foods high in fructose because of added sugar, raises blood glucose more than lower fructose foods because of the pathway explained in the previous section. In the
literature, the effect of fructose on blood sugar is conflicting, and may only have a negative effect when it causes an increase in caloric consumption overall. However, other research does show that fructose is metabolized primarily in the liver, and large influxes of fructose result in increased de novo lipogenesis and elevated serum triglycerides, which can lead to insulin resistance in the long term – still, the majority of fructose in Western diets comes from added sucrose, not fruit. Furthermore, the benefits of fiber and high micronutrient content of fruits, especially in low GI fruits like berries and grapefruit, may make them a beneficial food to incorporate as part of a lower carbohydrate breakfast; a similar approach could be applied to incorporate protein and micronutrient-rich milk at breakfast.

“Real Food” for GDM

Real Food for Gestational Diabetes: An effective alternative to the conventional nutrition approach is a book written by Lily Nichols RDN, CDE, who was also involved in the development of the CDAPP. Nichols also authored Real Food for Pregnancy: The science and wisdom of optimal prenatal nutrition, which focuses on general prenatal nutrition and prevention of GDM. In the beginning of her books, Nichols calls her approach “evidence-based;” while she most certainly does cite a lot of credible literature throughout the book, a good amount of her recommendations come from anecdotes and observations from clinical experience – she claims that in the perinatology clinic she worked in, they were able to reduce the amount of women with GDM dependent on insulin and medication by half, and saw better birth outcomes, using her real food approach. When the author was contacted to inquire about whether any clinical trials had been conducted on this approach, she replied that none had been done, but that
she was in talks with a large research university about a clinical trial that would hopefully provide results in the next 5 years. Because there is not yet clinical data to back up Nichols’ specific approach, it will be considered as practice-inspired instead of evidence-based.

Nichols defines “real food” as food that is “obtained locally and eaten in its natural, unprocessed form.” Nichols points out that current nutrition science tends to be very nutrient-focused, while traditional pregnancy wisdom tends to be very whole-food focused. Her approach goes beyond just carbohydrates – she claims that the conventional guidelines provided by the AND are “devoid” of nutrients, and that a lower CHO diet with plenty of whole foods and focus on animal-sourced proteins can help prevent GDM or improve blood glucose management for women who do have GDM. Instead of meticulous carbohydrate counting and portion measuring, Nichols recommends a combination of mindful eating strategies along with the Plate Method: “Aim for half of your plate to come from non-starchy vegetables, one quarter of your plate from proteins and fats, and the remaining one quarter to come from carbohydrates (generally no more than 1 cup total, or 30 grams of carbohydrates, at one sitting). Some women may need less than 30 grams of carbohydrates per meal to maintain normal blood sugar.” She suggests 15 g of CHO at breakfast, and recommends individualized testing of blood glucose response to fruit and milk in the morning. She also advocates for small frequent meals and snacks in accordance with hunger and fullness cues. Nichols emphasizes avoiding refined carbohydrates, added sugar, trans fats and artificial sweeteners. Instead, the real food approach focuses on low GI CHO sources
with more protein and fat – both saturated and “non-inflammatory” unsaturated fats (oils rich in omega-3 fatty acids instead of those rich in omega-6 fatty acids).

Nichols provides meal plans for a daily total of 90, 120, and 150 g CHO, stating that the DRI of 175 g CHO for pregnant women is outdated and rooted in a fear of ketosis that is not evidence-based. An entire chapter is focused on why nutritional ketosis is often confused with diabetic ketoacidosis, how modest amounts of ketones in the urine do not reflect ketones in the blood, and how ketone bodies are a normal part of a healthy pregnancy, and could even be beneficial to the fetus. Her argument for how ketosis could be healthy for the mother is that in obese women, minimal weight gain and even weight loss has been associated with better pregnancy outcomes, and this may be difficult to achieve without some level of ketosis. However, as cited earlier in this paper, less than recommended weight gain in pregnancy is associated with a higher risk of GDM even when controlling for BMI.

While Nichols has years of clinical experience to back up her claim that a low-carb, “real food” approach is safe and highly effective for pregnant women with GDM, there is a lack of evidence to back up her claims. Furthermore, the AND provides evidence that higher CHO diets may be just as effective for blood glucose control in GDM. However, encouraging adequate protein and micronutrient consumption from locally sourced produce, in combination with mindful eating strategies, is a difficult approach to dispute.
Psychological impacts of GDM and its treatment

The AND practice paper notes the importance of considering a woman’s psychosocial situation during assessment, monitoring and evaluation in MNT for GDM. Women with GDM experience elevated psychological distress, which manifests as anxiety about the outcomes of the condition, and stress related to the pressure to fulfill multiple roles and a disconnect between diabetes management strategies and cultural practices.

Women with GDM are at an increased risk for PPD, which may be a result of maternal psychological and physiological stress. Low-income women with GDM are at an even higher risk of experiencing PPD; they “expressed shock and disappointment over diagnoses and highlighted need for psychological support from health care professionals.”

For women with past or active eating disorders, the physical and mental health risks during pregnancy are high. One study showed that 22% of women with a past eating disorder had a relapse during pregnancy, and another study demonstrated that women with active bulimia nervosa during pregnancy are more likely to experience both GDM and PPD. Risk factors for eating disorders are a complicated combination of psychological, sociocultural, and biological factors, but distinctively include a 3-way relationship between depression, body dissatisfaction, and dieting. To prevent the onset or worsening of eating disorder behaviors in clients with GDM, the RDN must be conscious of the way weight gain and “compliance” with dietary strategies is approached.
An ethical dilemma in maternal nutrition care

In observation of MNT provided by RDNs at the Carolina Diabetes Center, there was an intense focus on fetal outcomes, even at the cost of limiting the normal enjoyment of foods. For example, an Israeli patient was told that she could not eat dates at all during the remainder of her pregnancy because of their sugar content – this left the patient feeling distraught and discouraged that a culturally familiar food would be eliminated for the sake of extreme precaution in avoiding macrosomia. These observations are corroborated by the results of a qualitative study on perspectives of women with GDM which revealed themes of “the disrupted pregnancy, projected anxiety, reproductive asceticism, women as baby machines, perceived stigma, lack of shared understanding and postpartum abandonment.” The researchers from this study found that this focus on a woman’s body solely as a means to produce a healthy infant led some participants to be less inclined to care for their own physical and mental health. This study in particular brings to light the need of the health care team to view the mother as an autonomous individual with her own physical and mental health care needs.

Furthermore, as stated earlier in this paper, the research is not actually clear on the long-term health risks of children born to women with GDM. Placing such high importance on fetal outcomes may be putting unnecessary strain on women with GDM, and further propelling the concerns noted by Parsons et al.

The theme of prioritizing fetal outcomes over maternal health is common in maternal-fetal medicine as a whole; even as the infant mortality rate in the US has dramatically improved in the last century, maternal mortality has increased in the last decade by 26%. To put this statistic in perspective, international rates of maternal mortality
have decreased, and the rate of maternal mortality among non-hispanic black women in the US is three to four times higher than the rate for non-hispanic white women.29,30

The code of ethics for RDNs focuses on four principles: autonomy, non-maleficence, beneficence, and justice.75,76 In the ethical dilemma of balancing maternal and fetal outcomes in a case of GDM, it is imperative that the RDN take a holistic approach to ethical decision making. This means acknowledging the pre-existing mental health issues of eating disorders and PPD among the GDM population, weighing the risks and benefits of a strict dietary regimen during pregnancy, allowing the patient to bring their autonomous needs and desires to the decision-making process, and lastly paying specific attention to personal and systemic biases that contribute to maternal health disparities among women of racial/ethnic minorities and women in larger bodies.77 RDNs can play an impactful role in improving maternal health outcomes in the US by taking an approach to ethical MNT that cares for the whole mother – body and mind.

**Implications for practice**

After acknowledging internal biases and making a commitment to an ethical, holistic approach, the RDN can weigh the evidence presented in this paper to decide which strategies will be most beneficial in the short and the long term for each individual client with GDM. Because evidence shows that different strategies may work for different clients, it is important that the RDN be flexible in changing the diet prescription when necessary – less than ideal blood glucose control may not always be a result of “non-compliance,” and could be rather an issue of intervention tailoring on behalf of the
Women with GDM are considered to be highly-motivated clients; fostering this motivation with continued encouragement of SMBG can help improve GDM management.\(^{78}\)

After birth, the RDN should continue to follow up with the client to help instill lifestyle habits that prevent T2DM.\(^{11,35,49,79}\) A study in a cohort of ethnically diverse, low-income women showed low perception of risk for developing T2DM after giving birth – counselling approaches that take into account cultural and health literacy appropriateness are of utmost importance.\(^{69}\) Furthermore, prenatal nutrition care that includes counselling on diet, exercise and future diabetes risk may enhance postpartum diabetes screening.\(^{34}\) On a systems level, only about half of women who have GDM in pregnancy are screened for T2DM in their postpartum visits; RDNs should continue to follow-up with their clients after delivery and also act as an advocate for their patients in requesting consistent T2DM screening in postpartum.\(^{80}\) Studies on barriers to follow-up with an RDN after birth specifically in the GDM population in the US are sparse; possible barriers that should be explored in future research include potentially low initial referral rates or low approved units of MNT by the referring provider, lack of Medicaid coverage for pregnancy services after delivery, low perception of risk for T2DM as noted by Singh et al, or general barriers to accessing care such as transportation and language differences. RDNs should also promote and support breastfeeding. Women with GDM have lower continuation rates of breastfeeding compared to non-diabetic women, but longer breastfeeding duration in women with GDM is associated with lower rates of progression to T2DM.\(^{81,82}\)
A focus on modifiable behaviors versus weight may serve double duty in preventing disordered eating and improving physical maternal health outcomes. Both mindful and intuitive eating strategies emphasize interoceptive awareness of hunger and fullness and de-emphasize focus on weight changes. Mindful eating and movement strategies can improve glycemic control for women with GDM during their pregnancies, and also help prevent T2DM after giving birth. In addition, intuitive eating is associated with lower overall BMI and lower odds of disordered eating behaviors. It may be a helpful tool in both preventing the development or recurrence of eating disorders, as well as in helping to manage blood glucose during pregnancy, postpartum, and beyond.

**Conclusion**

In conclusion, there are multiple dietary strategies that may be effective for optimal blood glucose control in women with gestational diabetes; lower carbohydrate strategies, especially those that provide less than the DRI of carbohydrate for pregnant women, may not have a greater benefit than higher but consistent carbohydrate diets that still provide adequate fiber, protein, and micronutrients. Using clinical judgment, compassion, and principles of ethical care, the registered dietitian nutritionist can choose an approach that optimizes fetal outcomes without compromising maternal mental and physical health. Methods that utilize mindful and intuitive eating may be highly effective in achieving this balance and can also be tailored to instill lifestyle behaviors that prevent type 2 diabetes in the long term. The role of the registered dietitian nutritionist is clear on the interdisciplinary team – multiple professional organizations advocate for medical nutrition therapy provided by a registered dietitian
nutritionist in the treatment of gestational diabetes. Moving forward, registered dietitian nutritionists in the maternal and child health field should seek to increase referral rates from obstetricians for medical nutrition therapy through local and national advocacy initiatives and continue to follow up with patients after delivery to establish health promoting behaviors individualized to each new mother’s life. With ethical nutrition care, a woman with gestational diabetes can expect optimal outcomes for both herself and her child.
References


