Medical Nutrition Therapy in Gestational Diabetes Mellitus

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• American Diabetes Association Standards of Medical Care in Diabetes- 2017
• Gestational diabetes mellitus (GDM) occurs in about 7% of all pregnancies (ranging from 1% to 14% depending on the population studied), resulting in more than 200,000 cases annually.

(ADA, 2014a)
Prevalence of GDM in Iran

• According to 14 studies from 1992-2007, the prevalence of GDM ranged between 1.3% to 10% in different regions of Iran.

Khoshnniat, 2009
Figure 1 – Iran’s map of GDM prevalence

(): The Reference Number, # Diagnosed with Carpenter & Coustan Criteria, † Diagnosed with NDDG Criteria, ‡ Diagnosed with 75 gram Oral glucose Tolerance Test and ADA Criteria, * These articles due to not applying the standard methods eliminated.
Risk factors for the development of GDM

- marked obesity
- older age
- **personal history of GDM**
- glycosuria
- strong family history of diabetes
- ethnicity
- polycystic ovary syndrome
- hypertension

Cheung, 2009
GDM Complication

- adverse pregnancy outcomes:
  - macrosomia
  - shoulder dystocia
  - Jaundice
  - polycythemia
  - respiratory distress
  - hypocalcemia

Cheung, 2009
GDM Complication (cont’)

**adverse pregnancy outcomes** (cont’)

- Increase fetal **malformation** and **perinatal mortality**
- predispose the child to a **diabetes** phenotype in later life

Cheung, 2009
GDM Complication (cont’)

Maternal complication:

- Weight gain
- Maternal hypertensive disorders
- Miscarriages
- Third trimester fetal deaths
- Cesarean delivery (due fetal growth disorders)
- Long term risk of type 2 diabetes mellitus
• Women who have had GDM have a 35% to 60% chance of developing diabetes in the next 5 to 10 years (CDC, 2014).
• Lifestyle modifications aimed at reducing or preventing weight gain and increasing physical activity after pregnancy may reduce the risk of subsequent diabetes.
• All women not previously known to have diabetes should be screened for GDM at 24 to 28 weeks of gestation.
• GDM is diagnosed most often during the second or third trimester of pregnancy because of the increase in insulin-antagonist hormone levels and insulin resistance that normally occurs at this time.
• GDM screening can be accomplished with either of two strategies:
• 1. “One-step” 3-hr 75-g OGTT. A fasting glucose ≥ 92 mg/dl, a 1-hour ≥ 180 mg/dL, or a 2-hr ≥ 153 mg/dl is diagnostic of GDM
• 2. “Two-step” approach with a 1-hr 50-g (nonfasting) screen followed by a 3-hr 100-g OGTT for those with plasma glucose ≥ 140 mg/dl. The diagnosis of GDM is made when the plasma glucose level measured 2 hr after the test is ≥ 140 mg/dl (7.8 mmol/L).
• During pregnancy, treatment to normalize maternal blood glucose levels reduces the risk of adverse maternal, fetal, and neonatal outcomes.
• Extra glucose from the mother crosses the fetal placenta and the fetus’ pancreas responds by releasing extra insulin to cope with the excess glucose. The excess glucose is converted to fat, which results in macrosomia.
• Women with GDM should be screened for diabetes 6 to 12 weeks postpartum and should have lifelong screening for the development of diabetes or prediabetes at least every 3 years (ADA, 2014b).
Medical Nutrition Therapy (MNT) in GDM
Medical Nutrition Therapy (MNT) in GDM

- MNT is the primary therapy for 30–90% of women diagnosed with GDM
Goals: Achieve **normoglycemia**

Recommended treatment targets

<table>
<thead>
<tr>
<th>Test</th>
<th>Gestational Diabetes (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting plasma glucose</td>
<td>≤95</td>
</tr>
<tr>
<td>1 hr postprandial</td>
<td>&lt;140</td>
</tr>
<tr>
<td>2 hr postprandial</td>
<td>&lt;120</td>
</tr>
<tr>
<td>h A1C</td>
<td>6–6.5%</td>
</tr>
</tbody>
</table>

ADA,2017
• Providing the **required nutrients** for **normal fetal growth** and **maternal health**

• **Prevent excessive maternal weight gain**, particularly in women who are overweight or have gained excess weight in pregnancy.

• **Prevent ketosis**
Medical Nutrition Therapy (cont’)

Include:

• **Nutrition therapy**
• **Exercise**
• **Self-monitoring of blood glucose (SMBG)**
• **Pharmacologic therapy**
• **Education**
Nutrition therapy
Efficacy of dietary therapy for GDM

Nutrition intervention for GDM has been recognized as the cornerstone of therapy

In patients receive diet therapy:

- Fewer patients require insulin therapy
- Decrease HbA1c
- Lower serious perinatal complications among the infants:
  - Lower birth weight
  - Lower % large-for-gestational-age
  - Less macrosomia

Crowther, 2005; Reader, 2006; Cheung, 2009
Nutrition therapy (cont’)

- All women should receive **individualized counseling**

- **Food plan** should be **individualized & culturally appropriate**

  to provide adequate calories & nutrients to meet the needs of pregnancy and consistent with the blood glucose goals

Cheung, 2009
There is no indication that normal-weight and underweight women with GDM should not follow the IOM weight-gain guidelines and calorie intake.
weight-gain recommendations based on prepregnancy BMI

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>weight-gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal 19.8 – 26.0</td>
<td>11.4 – 15.9 kg</td>
</tr>
<tr>
<td>overweight 26.1 – 29.0</td>
<td>6.8 – 11.4 kg</td>
</tr>
<tr>
<td>Obese &gt; 29</td>
<td>kg7</td>
</tr>
</tbody>
</table>

(Institute of Medicine’s Nutrition for Pregnancy 1990)
• Although caloric restriction must be viewed with caution, a modest energy restriction to slow weight gain is recommended for overweight or obese women with GDM.

• A slight calorie restriction results in a slowing of maternal weight gain in obese women with GDM without causing maternal or fetal compromise and/or ketonuria.

• Energy intake below approximately 1700 to 1800 kcal/day is not advised.
overweight and obese women: 

**Severe calorie restriction**, increases ketonuria and ketonemia

American Diabetes Association have suggested:

a 30–33% calorie restriction for obese women with GDM, noting a minimum 1600-1800 calorie

Ada, 2000
<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Recommended weight gain (lbs.)</th>
<th>Estimated calorie intake kcal/kg/day PPW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (&lt; 19.8)</td>
<td>28 – 40</td>
<td>36 – 40</td>
</tr>
<tr>
<td>Normal weight (19.8 – 26)</td>
<td>25 – 35</td>
<td>30</td>
</tr>
<tr>
<td>Overweight (26.1 – 29)</td>
<td>15 – 25</td>
<td>24</td>
</tr>
<tr>
<td>Obese (&gt;29)</td>
<td>15</td>
<td>12 – 18</td>
</tr>
<tr>
<td>Twin Gestation</td>
<td>35 – 45</td>
<td>Add an extra 500 kcal/day to the above recommendations</td>
</tr>
</tbody>
</table>

*Adopted from National Academy of Sciences Institute of Medicine Guidelines for Pregnancy*
Macronutrient intake

- **Carbohydrate (CHO)**: 50 to 55% kcal intake
- **Protein**: 20-25% kcal intake
- **Fat**: 25-30% kcal intake
<table>
<thead>
<tr>
<th>Guidelines</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA 5th International Workshop-Conference on GDM, 2005 (10)</td>
<td>Insufficient evidence; recommendations withdrawn</td>
</tr>
<tr>
<td>ADA Medical Nutrition Therapy Guidelines, 2013 (83)</td>
<td>Inconclusive evidence; individualization needed</td>
</tr>
<tr>
<td>ACOG Guidelines, 2013 (5)</td>
<td>Carbohydrate 33–40% of total calories</td>
</tr>
<tr>
<td>The Endocrine Society Guidelines, 2013 (55)</td>
<td>Carbohydrate 35–45% of total calories</td>
</tr>
<tr>
<td>American Heart Association/American College of Cardiology (AHA/ACC) Guidelines, 2013 (57)</td>
<td>Carbohydrate 55–59%, fat 26–27%, saturated fat 5–6%, and protein 15–18% of total calories</td>
</tr>
</tbody>
</table>
Dietary fat

• Diets high in fat may promote insulin resistance in part through elevation of tumor necrosis factor α and FFAs, resulting in impaired insulin signaling
• Elevated FFAs may also promote a β-cell defect
• Evidence suggests that higher pre- and early pregnancy intake of animal fats and cholesterol are associated with increased risk for GDM, implicating an effect of dietary fat and cholesterol on exacerbation of insulin resistance.
• Thus, there is concern that a low-carbohydrate diet that facilitates an unbalanced increase in fat may actually worsen maternal insulin resistance in GDM, contributing to intrauterine overnutrition.
Insulin is a hormone with many functions beyond glucose control. It serves as a suppressor of FFA release (lipolysis) from stored triglyceride in adipose tissue.

With better insulin action, there is better insulin suppression of lipolysis, less FFA exposure over time, and improved tissue sensitivity to insulin.
Nutrition therapy (cont’)

• **CHO** are an important dietary source of energy, vitamins, minerals & fiber content.

• **CHO** is the main nutrient that affects postprandial glucose levels.

• **CHO intake can be manipulated by:**
  
  - controlling the total *amount of CHO*
  - *distribution of CHO* over several meals and snacks
  - *type of CHO*
Meal Plan Components

• Maintain a minimum of 175 grams of carbohydrate or 12 carbohydrate choices per day (approximately 700 kcals from carbohydrates).

• Smaller meals should contain no more than one or two carbohydrate choices (15-30 grams of carbohydrate)

• larger meals no more than three to four carbohydrate choices (45-60 grams of carbohydrate).
The ADA Standards of Medical Care state:

• **glycemic index (GI)** can provide additional benefit to total carbohydrate control

  ✤ **Foods with a low GI (<55)** produce a lower postmeal glucose elevation

  ✤ **Foods with a high GI (>70)** show higher postprandial glucose values
Nutrition therapy (cont’)

Fiber:

- Soluble (legumes, oats, fruits)
- Insoluble (whole grain breads, cereals and some vegetables)

Both:

- ✓ increase satiety
- ✓ slowing absorption time
- ✓ lower glycemic index
Carbohydrate Counting

Works as follows:

✅ a dietitian determines a person’s dietary needs

✅ the individual is given a daily CHO allowance

✅ divided into a pattern of meals & snacks according to individual preferences

✅ the carbohydrate allowance can be expressed in grams or as the number of carbohydrate portions allowed per meals
Carbohydrate Counting

• Emphasis is given to spreading the dietary intake over six meals daily:
  
  • 3 main meals
  • 3 snacks

Distribution of CHO in daily meals

<table>
<thead>
<tr>
<th>meals</th>
<th>Breakfast</th>
<th>Snack1</th>
<th>Lunch</th>
<th>Snack2</th>
<th>Dinner</th>
<th>Snack3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHO%</td>
<td>15%</td>
<td>10%</td>
<td>30%</td>
<td>10%</td>
<td>20%</td>
<td>15%</td>
</tr>
</tbody>
</table>
• Distribute carbohydrate-containing foods into smaller, frequent meals evenly spaced throughout the day. When total calories are divided into smaller, more frequent meals, the pancreas is often able to secrete adequate amounts of insulin and this may prevent the need for medications and minimize hunger, ketones in the urine, heartburn and nausea.
• Schedule at least two hours between meals to allow for two-hour postprandial blood glucose levels.

• It is best not to allow more than 10-12 hours between the last evening meal and the next morning meal.

• Consider including a small snack at bedtime (one carbohydrate choice and one protein choice) to help prevent ketone formation, especially if dinner and breakfast are separated by more than 10-12 hours.
• Use a food and beverage record to track intake. Include type and amount (cups, etc.) of food eaten, meal times, and fasting and postprandial blood glucose levels (one or two hours after the start of the meal).
Nutrition therapy (cont’)

• Additional dietary components are usually based upon the general recommendations for diabetes mellitus.

• A reduction in simple carbohydrates and fat intake is advisable
<table>
<thead>
<tr>
<th>Food Group</th>
<th>Breakfast</th>
<th>Snack</th>
<th>Lunch</th>
<th>Snack</th>
<th>Dinner</th>
<th>Snack</th>
<th>Total servings/day</th>
<th>CHO (g)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Calories/gram (X4=)</th>
<th>Percent calories (X9=)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starches</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>8</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meats/Substitutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>5(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fats</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>CHO Choices</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Calculations are based on medium-fat meats and skim/very low-fat milk. If diet consists predominantly of low-fat meats, use the factor 3 g fat instead of 5 g fat; if predominantly high-fat meats, use 8 g fat. If low-fat (2%) milk is used, use 5 g fat; if whole milk is used, use 8 g fat.
Fat intake:

- less than 10% SFA
- up to 10% PUFA
- the remainder derived from MUFA

Nutrition therapy (cont’)

Cheung, 2009
Nutrient needs

- There is **no indication** that women with GDM should not follow the **same guidelines** for nutrient intakes **for all pregnant women**

*(Dietary Reference Intakes for pregnancy 2001)*
<table>
<thead>
<tr>
<th>Nutrient</th>
<th>RDA or AI* for pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td>+340 kcal/day second trimester</td>
</tr>
<tr>
<td></td>
<td>+452 kcal/day third trimester</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>175 g/day</td>
</tr>
<tr>
<td>Total fiber</td>
<td>28 g/day*</td>
</tr>
<tr>
<td>Linoleic acid</td>
<td>13 g/day*</td>
</tr>
<tr>
<td>α-Linolenic acid</td>
<td>1.4 g/day*</td>
</tr>
<tr>
<td>Protein (g · kg⁻¹ · day⁻¹)</td>
<td>1.1 (additional 25 g/day)</td>
</tr>
<tr>
<td>Total water</td>
<td>3.0 l/day (∼12 cups)</td>
</tr>
<tr>
<td>Sodium</td>
<td>1.5 g/day*</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.7 g/day*</td>
</tr>
<tr>
<td>Calcium</td>
<td>1,000 mg/day</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.7 g/day</td>
</tr>
<tr>
<td>Magnesium</td>
<td>350 mg/day</td>
</tr>
<tr>
<td>Copper</td>
<td>1,000 μg/day</td>
</tr>
<tr>
<td>Iodine</td>
<td>200 μg/day</td>
</tr>
<tr>
<td>Iron</td>
<td>27 mg/day</td>
</tr>
<tr>
<td>Zinc</td>
<td>11 mg/day</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>770 μg/day retinol activity equivalents</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>85 mg/day</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>5 μg/day*</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>15 mg/day</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>90 μg/day*</td>
</tr>
<tr>
<td>Thiamin</td>
<td>1.4 mg/day</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>1.4 mg/day</td>
</tr>
<tr>
<td>Niacin</td>
<td>18 mg/day</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>1.9 mg/day</td>
</tr>
<tr>
<td>Folate</td>
<td>600 μg/day</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>2.6 μg/day</td>
</tr>
</tbody>
</table>

From the Food and Nutrition Board, Institute of Medicine (20). *AI, adequate intake; RDA, recommended dietary allowance.
Exercise

• **Exercise** is an *obvious adjunct therapy* to MNT for women with GDM

• The ideal form of exercise is unknown, but a brisk walk after meals is often recommended (Krause 2017).

• **light and moderate intensity activities** such as walking for 20–30 min/day:

  ✓ can be *safely encouraged*,

  ✓ modest improvements in glycemic control might be achieved
Pharmacologic therapy

Criteria for adding pharmacological therapy such as insulin or glyburide:

• One or more blood glucose values outside the target range within a designated time frame.

• Elevated fasting glucose values alone
CONCLUSIONS

Nutrition recommendations for women with GDM, including:

- Management of gestational weight gain
- Control of calorie intake
- Modifying macronutrient composition & distribution
- Providing vitamins & minerals to meet pregnancy's need
The food plan should be designed to:

- Fulfill **minimum nutrient requirements** for pregnancy
- Achieve glycemic goals without **weight loss** and **ketonemia**
- Be **culturally appropriate** and **individualized** to take into account the patient’s body habitus, weight gain, and **physical activity**
Nutrition interventions for GDM emphasize

- healthy food choices
- portion control
- Cooking practices

that can be continued postpartum and may help prevent later diabetes, obesity, cardiovascular disease, and cancer
• An important goal of nutrition counseling is to facilitate changes in existing food and nutrition-related behaviors and the adoption of new ones.
• The combined use of behavior change theories may potentially have a greater impact than any individual theory or technique used alone (Franz et al, 2012).
• The following “five As” can guide the education/counseling sessions:
• The “ask” step emphasizes the importance of questions as the RDN aims to develop a relationship with the client. Motivational interviewing techniques are used initially and throughout all of the encounters.

• In the “assess” step, the RDN evaluated the client’s readiness to change. Different intervention strategies may be needed for individuals at different stages of the change process.
• The “advise” step uses a client-centered framework that adapts nutrition interventions to meet the client’s needs, wants, priorities, preferences and expectations.

• In the “agree” step the RDN facilitates the client’s process of setting his or her own short-term goals related to nutrition, physical activity, or glucose monitoring (if appropriate) and helps outline the client’s potential methods for accomplishing lifestyle changes.
• In the “arrange” step, plans for follow-up are identified to evaluate responses to nutrition interventions.

• The individual also is given information on how to call or email with questions and concerns.

• In making plans for the next encounter, the patient is asked to keep a 3-day or weekly food record with blood glucose–monitoring data.
Barriers to treatment

• Stress, Anxiety, and Fear as Barriers to GDM Nutrition Therapy Treatment
با تشکر از توجه شما