Carbohydrate Counting: Basic to Advanced

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IHS Division of Diabetes
Outline:

• Carb Awareness
• Basic/Consistent
• Advanced
Counting “Carbs”

- Carbs in Honey Bun? ___g
- Carbs in 1 block package of Ramen? ___g
- Favorite foods with Carbs?
- Carb Counting Resources: ___________________________
Carbohydrate Counting

- MNT works!
- One of many meal planning approaches
- Carbs - Up BG
- Continuum - Individualized
  - Carb Awareness
  - Basic – Consistent Carbohydrates
  - Advanced – Carb/Insulin Ratio

Standards of Medical Care in Diabetes - 2013. Diabetes Care.
Assessment

• A1C target met?
• SMBG?
• Typical meal pattern
• Medications?
• Health literacy & numeracy
• Meal planning approach? ______________
  • Introduce concept of carbohydrate counting
  • Establish carbohydrate target ranges
Factors Influencing BG

- Amount of carbohydrates
- High fat foods/meals
- Incorrect insulin dose/missed dose
- Other medications
- Injection site
- Physical activity
- Stress
- Illness
- ____________________
Healthy Eating – General Recommendations:

- Choose healthy foods (fruits/veg/whole grains/lean protein/unsaturated fats)
- Set an eating schedule, i.e.,
  - Eat 3 small-to-medium sized meals; include some carbs/meal
- Avoid “liquid sugar”
- Meal plans to consider...
Carb Awareness

• Identify foods that do and do not contain carbs
• A Controlled Carb meal plan...not a Low Carb meal plan
• RDA 130 g/day (≈ 9 choices)
• Average adult carb intake ___%Kcal?
• Individualize the amount of carb for meals and snacks/day
• Estimate accurately amount of carbs in food servings

DCCT, Look AHEAD, NHANES
http://ndb.nal.usda.gov/ndb/search/list
What foods have carbohydrates?

- Breads, cereals, and grains
- Starchy vegetables
- Dried beans and lentils
- Fruits
- Milk and yogurt
- Sweets, desserts, regular soda
What foods have little or no carbohydrates?

- Non-starchy vegetables
- Meat, poultry, fish, eggs,
- cheese, soy/meat substitutes
- Fats/oils
Plate Method – Carb Awareness

http://www.ihs.gov/MedicalPrograms/Diabetes/HomeDocs/Resources/InstantDownloads/MyNativePlate1_508c.pdf

For people who:

- Are less active
- Are older
- Need to eat less calories

At meals, keep rice, beans, pasta, and starchy veggies to one-fourth of a place, add one serving fruit, and/or one serving milk/yogurt

Plate Method – Carb Awareness (cont.)

http://www.ihs.gov/MedicalPrograms/Diabetes/HomeDocs/Resources/InstantDownloads/MyNativePlate1_508c.pdf

For people who:

• Are active
• Are younger
• Want to stay at same weight

At meals, keep rice, beans, pasta, and starchy veggies to one-half of a plate, add one serving fruit, and/or one serving milk/yogurt
IHS DDTP Resources

http://www.ihs.gov/MedicalPrograms/Diabetes/RESOURCES/Catalog/index.cfm

Eating Issues and Nutrition Tips for Educators Using

MY NATIVE PLATE

My Native Plate provides a visual guide to help your clients and patients eat balanced meals of reasonable portion sizes. Use it as a starting point for nutrition education, a daily reminder, and a way to introduce healthy eating to family members of all ages. Read the following 11 issues to Consider prior to using My Native Plate. Download and distribute Ten Tips to a Great Plate™ when your clients are ready for more information.

Issues to Consider

Understanding a few issues that affect people’s eating habits can help you introduce My Native Plate to your clients. Keep these points in mind and discuss them in a positive, supportive way:

1. Emotions and stress can impact your clients’ food selection and portion sizes. The reasons why people eat certain foods, and why they overeat, are often linked to depression, anxiety and stress.
   - Ask your clients what they are eating, how much and possible reasons why.
   - Refer them to other health care professionals, spiritual leaders or counselors if needed.

2. Not consistently having enough money to buy good quality food will affect your clients’ eating habits. Food insecurity can cause your clients to overeat available foods, skip meals and/or choose unhealthy foods that are less expensive.
   - Find out if your clients have consistent access to nutritious foods and are getting enough nutrition from the foods they usually eat.
   - Refer them to community food resources if needed.

3. Family and social gatherings are important to your clients and can affect healthy eating. Not eating from a balanced, wholefood, meatless and caffeine-free diet can be consolidated into. Suggest ways your clients...
How do you count carbs?

- Count grams of carbohydrate
- Count carb choices ("servings", "exchanges")

15 grams = 1 carb choice
- Reliable websites:
  - Calorie King
    www.calorieking.com
  - USDA Nutrient Database
    http://ndb.nal.usda.gov

To determine amount:
- Weigh and measure with portion control tools
- Ask patients to measure portions using their plates, bowls, & glasses
- Use food models as a teaching tool
# 1 Carb Choice = 15 g. Carbohydrates

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Serving Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread, cereal</td>
<td>1 slice, ¾ cup unsweetened</td>
</tr>
<tr>
<td>Pasta, rice</td>
<td>1/3 cup</td>
</tr>
<tr>
<td>Starchy veg – potato, corn, beans</td>
<td>½ cup</td>
</tr>
<tr>
<td>Fruit</td>
<td>1 small piece, ½ cup canned</td>
</tr>
<tr>
<td>Milk &amp; plain yogurt</td>
<td>1 cup</td>
</tr>
<tr>
<td>Sweets/snack foods</td>
<td>2 small sandwich cookies, ½ cup ice cream, 15 snack chips, 1 tbsp. jelly</td>
</tr>
<tr>
<td>Nonstarchy vegetables</td>
<td>3 cups raw (salad), 1 ½ cups cooked</td>
</tr>
</tbody>
</table>
Basic/Consistent Carbohydrate Intake

- Emphasize day-to-day consistency
- General Targets
  - Premeal 70-130 mg/dL
  - 2° postmeal <180 mg/dL
- Improve glycemic control through managing patterns of BG as they relate to food intake, diabetes medication, and physical activity.

- Client willing to keep food, BG, physical activity records
- Client willing to weigh/measure food portions
- Educator teaches:
  - carbohydrate grams or choices
  - portion sizes
  - BG/food/activity patterns
General Guidelines: Carbs/Meal

Women
- To lose weight
  - 30-45 g
- To maintain weight
  - 45-60 g
- For very active
  - 60-75 g
- Snacks: 15-30 g

Individulize

Men
- To lose weight
  - 45-60 g
- To maintain weight
  - 60-75 g
- For very active
  - 60-90 g
- Snacks: 15-30 g

Individulize
Reading Nutrition Facts Label

1. Find the serving size – compare to actual portion eaten
2. Find Total Carbohydrate*
3. Count grams of carbs or carb choices
   • 1 cup = 31 g. carbohydrate or
   • 1 cup = 2 carb choices

• *Dietary fiber, sugars, sugar alcohols included in Total Carbohydrate
Basic Patient Education Resources


AADE7™ Self-Care Behaviors: Healthy Eating 2-page download; available at: 
http://www.diabeteseducator.org/export/sites/aade/_resources/pdfs/general/AADE7_healthy_eating.pdf

http://www.idcpublishing.com/My-Food-Plan-Made-Easy/productinfo/2058-MFPE/
Patient Education Resources

My Food Plan.
My Food Plan for Gestational Diabetes.
4-fold with 8 panels, carb counting guide.
Carbohydrate Counting. 31p booklet.
International Diabetes Center.
http://www.idcpublishing.com

Ready, Set, Start Counting:
Carbohydrates Counting.
3-page download. Free. DCE Organization.
http://www.dce.org/publications/education-handouts/#ed

Grocery Store Tour
Customized collection of nutrition facts labels (laminated) in a 3-ring binder.
Mobile Apps

GoMeals.com

www.mynetdiary.com
MyNetDiary Diabetes Tracker App
Top Rated Apps by Patients

Apple App
• Calorie Counter by MyFitnessPal
• Calorie King
• Calorie Counter by MyNetDiary

Android App
• Calorie Counter by MyFitnessPal
• Diet and Calorie Tracker by Sparkpeople
• Calorie Counter by FatSecret

Advanced Carbohydrate Counting

• Match fast-acting insulin doses to carb intake based on carb-to-insulin ratios and correction factors
• 31% - insulin therapy (2012 IHS DM audit)

• Understand BG targets
• Accurately count carbs
• Willingness/ability to keep food, activity, insulin, BG logs
• See BG patterns, make adjustments
• Multiple visits, reinforcement, ongoing support from DM team

Carb-to-Insulin Ratio

• Helps determine bolus dose of fast-acting insulin to “cover” the carbs at a meal or snack.

• Total grams of carbs disposed by X unit(s) of insulin

# g carb ÷ # units bolus insulin = ___ g carb/1 unit insulin
Determine Carb:Insulin Ratio

1. Quick and Easy Method
2. Pattern Management
3. Rule of 500 or Rule of 450

UC San Francisco Diabetes Teaching Center
Determine Carb:Insulin Ratio
Quick and Easy Method

# g carb ÷ # units bolus insulin = ___ g carb/1 unit insulin

• Starting ratios:
  • 15:1 (15 g carb for 1 unit fast-acting insulin)
  • Ratios vary
    • 10:1 (insulin resistant/obese)
    • 20:1 (young, thin)
Determine Carb:Insulin Ratio
Pattern Management

- Review food, insulin, and BG records (3-7 days)
- Identify trends
- Gram Method
  - Carb (g) ÷ X units bolus insulin = __ g carb/1 UI
  - Case Study: Usually eats 70 grams Carb for dinner, and he takes 7 units insulin

70 g carb ÷ 7 units insulin = 10:1 (carb:insulin ratio)
10 g. carb covered by 1 unit insulin
Determine Carb: Insulin Ratio

500 and 450 Rule (Type 1)  
Walsh J, Roberts R. The Pocket Pancreas, 2000

500 \( (450) \div \) total daily dose (TDD) of fast-acting insulin

**Case Study**: Total daily dose is 50 units rapid-acting insulin = 
500 \( ÷ 50 = 10 \) g carb covered by 1 unit rapid-acting insulin = 10:1

<table>
<thead>
<tr>
<th>Total daily dose of insulin</th>
<th>500 Rule</th>
<th>450 Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carb (g) covered by 1 unit rapid-acting insulin</td>
<td>Carb (g) covered by 1 unit regular insulin</td>
<td></td>
</tr>
<tr>
<td>20 units</td>
<td>25 g</td>
<td>23 g</td>
</tr>
<tr>
<td>25</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>30</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>35</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>40</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>60</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>
Carb: Insulin Ratio

Case Study:

<table>
<thead>
<tr>
<th>breakfast</th>
<th>lunch</th>
<th>dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:1</td>
<td>15:1</td>
<td>15:1</td>
</tr>
</tbody>
</table>

Lunch: Cheeseburger (35 g)  
small salad (4 g)  
vinaigrette dressing (3 g)  
1 chocolate chip cookie (21 g)  
diet soda (0 g)

Total carbs for lunch? _____ g.

How much insulin should she take before lunch? ___units

If BG out of target range:

- If 2 hr PPG is too high – decrease ratio: less carb/unit insulin
  - Go from 15:1 ratio to 10:1 ratio
- If 2 hr PPG is too low – increase ratio: more carb/unit insulin
  - Go from 15:1 ratio to 20:1 ratio
Carb:Insulin Ratio

**Median Carb / Insulin ratios**

- **At Breakfast-time**: 2.5 Carb./IU
- **At Lunch-time**: 3.33 Carb./IU
- **At Dinner-time**: 3.12 Carb./IU

**Preferably N>2 for a reliable Carb / Ins ratio.**

C/I-ratio is calculated when:
- pre-meal blood glucose 4-7 mmol/L (70-125 mg/dl)
- post-meal blood glucose 4-9 mmol/L (70-160 mg/dl)
- insulin dose available
What is an Insulin Correction Factor?

• Used to calculate the amount of bolus insulin to bring BG into target range
• This adjusts or corrects a BG that is higher or lower than desired before a meal
• Ex: 1 unit of insulin to drop BG by 50 mg/dL

• General BG Range Targets
  • Pre-meal 70-130 mg/dL
  • Post-meal <180 mg/dL (2 hours after first bite)

• Individualize

ADA Clinical Practice Recommendations, 2013
Using Insulin Correction Factor

Current Blood Glucose – Target Blood Glucose

Insulin Correction Factor (X points)

Case Study:

Assume 1 unit will drop blood glucose 35 points (insulin correction factor)

Pre-meal BG = 190 mg/dL
Target BG = 120 mg/dL

Insulin correction dose = difference between the actual BG minus target BG divided by the correction factor

\[
\frac{190 \text{ mg/dL} - 120 \text{ mg/dL}}{35} = \frac{70}{35} = 2 \text{ units of insulin}
\]
Case Study:
Plan to eat 60 g of carb.
Carb:insulin ratio is 10:1 (10 g. carb covered by 1 unit of insulin)
60 g. carb ÷ 10 = 6 units of insulin needed for this amount of carbs

And assume 1 unit will drop blood glucose 35 points (insulin correction factor)

Pre-meal BG = 190 mg/dL
Target BG = 120 mg/dL

Insulin correction dose = difference between the actual BG minus target BG divided by the correction factor
190 mg/dL – 120 mg/dL = \( \frac{70}{35} = 2 \) units of insulin

\[
\begin{align*}
6 \text{ units (carbohydrate coverage dose)} & + 2 \text{ units (BG correction dose)} \\
\text{Total Mealtime Insulin Dose} & = 8 \text{ units}
\end{align*}
\]
Mealtine Insulin Dosing: Simple Algorithm vs. Carb Counting

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Basal</th>
<th>Bolus</th>
<th>TDD</th>
<th>A1C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algorithm</td>
<td>53.9</td>
<td>53.9</td>
<td>107.8</td>
<td>8.1</td>
</tr>
<tr>
<td>Carb Count</td>
<td>50.5</td>
<td>50.5</td>
<td>100.9</td>
<td>8.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>At 24 Weeks</th>
<th>Basal</th>
<th>Bolus</th>
<th>TDD</th>
<th>A1C</th>
<th>Weight Gain (lb.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algorithm</td>
<td>108.7</td>
<td>102.5</td>
<td>207.4</td>
<td>6.7</td>
<td>7.9</td>
</tr>
<tr>
<td>Carb Count</td>
<td>88.9</td>
<td>86.4</td>
<td>175.5</td>
<td>6.5</td>
<td>5.3</td>
</tr>
</tbody>
</table>

### Basal Insulin Adjustments

<table>
<thead>
<tr>
<th>Mean of last 3-day fasting SMBG mg/dl</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;180 mg/dl</td>
<td>Increase 8 units</td>
</tr>
<tr>
<td>140–180 mg/dl</td>
<td>Increase 6 units</td>
</tr>
<tr>
<td>120–139 mg/dl</td>
<td>Increase 4 units</td>
</tr>
<tr>
<td>95–119 mg/dl</td>
<td>Increase 2 units</td>
</tr>
<tr>
<td>70–94 mg/dl</td>
<td>No change</td>
</tr>
<tr>
<td>&lt;70 mg/dl</td>
<td>Decrease by the same number of units as insulin glulisine</td>
</tr>
</tbody>
</table>

## Bolus Insulin Adjustments

### Simple Algorithm

<table>
<thead>
<tr>
<th>Mealtime dose</th>
<th>Pattern of mealtime BG below target</th>
<th>Pattern of mealtime BG above target</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 10 units</td>
<td>Decrease by 1 unit</td>
<td>Increase by 1 unit</td>
</tr>
<tr>
<td>&gt; 11-19 units</td>
<td>Decrease by 2 units</td>
<td>Increase by 2 units</td>
</tr>
<tr>
<td>≥20 units</td>
<td>Decrease by 3 units</td>
<td>Increase by 3 units</td>
</tr>
</tbody>
</table>

### Carb Counting

<table>
<thead>
<tr>
<th>Mealtime dose</th>
<th>Pattern of mealtime BG below target</th>
<th>Pattern of mealtime BG above target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 unit/20 g</td>
<td>Decrease to 1 unit/25 g</td>
<td>Increase to 1 unit/15 g</td>
</tr>
<tr>
<td>1 unit/15 g</td>
<td>Decrease to 1 unit/20 g</td>
<td>Increase to 1 unit/10 g</td>
</tr>
<tr>
<td>1 unit/10 g</td>
<td>Decrease to 1 unit/15 g</td>
<td>Increase to 2 units/15 g</td>
</tr>
<tr>
<td>2 units/15 g</td>
<td>Decrease to 1 unit/10 g</td>
<td>Increase to 3 units/15 g</td>
</tr>
<tr>
<td>3 units/15 g</td>
<td>Decrease to 2 units/15 g</td>
<td>Increase to 4 units/15 g</td>
</tr>
</tbody>
</table>


IHS Division of Diabetes    2013
Resources for Intensive Therapy

**Complete Guide to Carb Counting.**

**Blood Glucose Pattern Control: A Guide for People Who Use Insulin.**
3rd Edition. 36 pages. International Diabetes Center

**IHS DDTP**
- **When and How to Use Insulin Therapy in Type 2 Diabetes.** Richard M Bergenstal, MD (podcast)
- **Advanced Strategies for Diabetes Management: Case Presentations.** JoEllen Habas, MD (recorded seminar)
- **Individualizing Diabetes Targets: One Size Does Not Fit All.** Ann Bullock, MD (Advancements webinar)
- **Update on Self-Monitoring Blood Glucose.** Marie Russell, MD MPH (Advancements webinar)
- **Nutrition for Diabetes Prevention & Care (Best Practice)**
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Wishing you much success!