Nutrition for Diabetes

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Learning Objectives

At the end of this presentation, the participant will be able to:
1. Describe different carbohydrate foods and their portion sizes.
2. Define different types of dietary fats.
3. Discuss the importance of dietary fiber.
4. Discuss the safety of non-nutritive sweeteners.

Facts About Carbohydrates

- Primary source of energy
- Occur in one of three forms
  - Monosaccharides
    - Glucose, fructose, galactose
  - Disaccharides
    - Sucrose, lactose
  - Polysaccharides
    - Starch (amylose or amylopectin containing foods)
    - Fiber - non-starch polysaccharides (non-digestible carbohydrate)

Carbohydrate Digestion

- Most circulating glucose (approx. 90%) comes from CHO digestion
- Monosaccharides
  - Glucose enters circulation via the portal vein
  - Fructose & galactose metabolized by liver into glycogen or triglycerides (fructose)
  - Little fructose or galactose converts to glucose and enters circulation as such

Disclosure

Aimee Wauters, MS, RD, LD, CDE has no relationships with commercial companies to disclose.

What are the Different Carbs?

- No longer are carbs “Complex” or “Simple”
  - cannot be defined by chemical structure
- Carbs are referred to as:
  - Sugars - mono- & disaccharides
  - Starch - polysaccharides (amylose or amylopectin containing foods)
  - Fiber - non-starch polysaccharides (non-digestible carbohydrate)
**Carbohydrates**
15 g CHO per serving
- Milk and Yogurt
  - Skim/Fat-Free or 1% is best
  - 1 cup serving
- Starch
  - Includes grains, cereals, & starchy vegetables
  - Approximately ½ cup servings
- Fruit
  - 1 cup serving or the size of a tennis ball
  - ½ cup if canned or juice
- High fat milk (2% or whole): 1 cup

**STARCH**
15 g CHO per serving
- dry cereal, unsweetened, 3/4 cup
- cooked cereal, 1/2 cup
- bread, 1 slice
- bun (hamburger), 1/2
- bun (hotdog), 1/2
- bagel, 1/2
- dried beans, cooked, 1/2 cup
- dried beans, baked, 1/4 cup
- corn, 1/2 cup
- lima beans, 1/2 cup
- potato, (baked), 3 oz
- potato (mashed), ½ cup
- winter squash, 1 cup
- popcorn, 3 cups (popped, plain)
- pretzels, 3/4 oz
- pasta, (cooked) 1/3 cup

**MILK**
12-15 g CHO per serving
- Milk (skim or 1%): 1 cup
- Yogurt (light): ½ cup

**FRUIT**
15 g CHO per serving
- apple (2"), 1
- apricot, 1/2 cup
- banana (9"), 1/2 cup
- cantaloupe (cubed), 1 cup
- cherries, 1/2 cup
- grapefruit, (medium), 1/2
- grapes, 1/2 cup (about 15)
- orange (2¾"), 1
- peach (2½"), 1
- pear (small), 1
- pineapple, 1 1/3 cup
- raspberries, 1 cup
- strawberries, 1¼ cup
- watermelon, 1 ½ cup
- juices, ½ cup

**VEGETABLES**
serving size = ½ cup cooked, 1 cup raw
- asparagus
- beans (green, wax)
- beets
- broccoli
- Brussels sprouts
- cabbage
- carrots
- cauliflower
- green pepper
- kale, leafy greens
- mushrooms (cooked)
- onions
- spinach
- tomatoes
- turnips

**Application of Basal/Bolus Therapy**
- Comprised of long-acting insulin (glargine) and rapid-acting insulin (aspart or lispro)
  - Dosed based on weight and pubertal staging
  - Long-acting insulin given once daily (basal)
  - Rapid-acting insulin given at meal times using a carb ratio and correction factor (bolus)
- Carb Ratio
  - Calculates insulin needed to cover carbohydrates eaten
  - Common ratios: 1:15, 1:10, 1:20, 2:15
- Correction Factor
  - Calculates insulin needed to correct an elevated blood sugar back into appropriate range
  - Common corrections: 1:50>150, 1:25>150, 1:30>130
Determine the bolus dose

- Chris is getting ready to eat lunch
  - Ham sandwich, small apple, 8 oz skim milk = 60 g CHO
  - Carb ratio 1 unit/15 grams CHO
- Pre-lunch blood glucose is 180 mg/dL
  - Correction is 1 unit/50 > 150 mg/dL
- Chris received a total of 5 units of rapid-acting insulin
  - 4 for CHO, 1 for glucose

Carbohydrate & the Glycemic Index

- Compares effects of a 50g carbohydrate serving to a standard 50g carbohydrate load
  - standard load = go A1C or white bread
- Studies of use of low glycemic foods are contradictory
  - Insufficient evidence to support use of only low glycemic index foods
  - May reduce postprandial hyperglycemia
  - Other nutrition strategies show more success in overall glycemic control
  - Can be used to compare pre and post-meal glucose readings for fine tuning post-meal hyperglycemia

As for “Sugar-Free” Foods...

- Many “sugar-free” foods are sweetened w/ sugar alcohol (polyols)
  - Sorbitol, mannitol, xylitol
  - Yield a lower glucose response than sucrose or glucose
  - They do contribute calories (2 kcal/g)
  - Ingestion of some polyols in excess of 10g/day can cause diarrhea or GI upset

What About the Sweeteners?

- Non-nutritive sweeteners DO NOT contribute to serum glucose levels
- FDA approved
  - Saccharin, aspartame, sorbitol, acesulfame K, neotame
- Safe for public consumption – kids too
- Safe in pregnancy
  - Saccharin can cross placenta, but no evidence of harmfulness to fetus
- Acceptable Daily Intake (ADI)
  - Amount of food additive that can be safely consumed daily for life without ill effects
  - Includes a 100-fold safety factor

How much is too much?

- The ADI of aspartame is 50 mg/kg of body weight/day

<table>
<thead>
<tr>
<th>ADI/kg</th>
<th>50 lb adult</th>
<th>50 lb child</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packets</td>
<td>57</td>
<td>32</td>
</tr>
<tr>
<td>Powdered beverage (8 oz)</td>
<td>34 servings</td>
<td>11 servings</td>
</tr>
<tr>
<td>Soda (12 oz)</td>
<td>20 cans</td>
<td>7 cans</td>
</tr>
</tbody>
</table>

- The ADI of sucralose is 5 mg/kg of body weight/day

<table>
<thead>
<tr>
<th>ADI/kg</th>
<th>50 lb adult</th>
<th>50 lb child</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packets</td>
<td>29</td>
<td>10</td>
</tr>
<tr>
<td>Soda (12 oz)</td>
<td>12 cans</td>
<td>4 cans</td>
</tr>
</tbody>
</table>
Juice is mostly inulin turns to monosaccharide when heated

- **Natural Sweeteners**
  - *Stevia* (NNS)
    - Steviol glycosides extracted from leaves of *Stevia rebaudiana*
  - *Agave nectar* (NS)
    - Produced from heart of agave plant (like tequila)
  - *Honey* (NS)
    - Extracted from hive & filtered; also available raw; sucrose
  - *Maple syrup* (NS)
    - Tapped from trees, boiled to yield product, filtered, bottled; sucrose
  - *Cane sugar* (NS)
    - Sticky, brown granules extracted before refining takes place

- **What is fiber?**
  - Known for helping move food through the body
  - Has many known beneficial effects:
    - Heart disease: Fiber may aid in the prevention of heart disease by helping lower your cholesterol.
    - Digestive Problems: Adequate amounts of fiber from foods can help prevent constipation and increase gut microflora.
    - Weight Gain: A high-fiber eating plan is lower in calories and tends to make you feel full faster.
    - Diabetes: Fiber slows post-prandial digestion and glucose absorption.

- **Soluble v. Insoluble fiber**
  - **Soluble**
    - Attract water to form gel
    - Slows gastric emptying
    - Helps feel fuller longer
    - Diabetes: delays the rise of blood glucose
  - **Insoluble**
    - Interferes with LDL absorption
    - Sources: oatmeal, nuts, flaxseed, apples, blueberries, celery, strawberries, oranges, beans, pears, carrots, cucumbers, psyllium

- **Dietary Fiber**
  - Recommendations for diabetics are the same as for the general population
  - Current recommendation:*  
    - 25 grams/day for women  
    - 38 grams/day for men
  - Children: No set DRI, but 5g + 1g/y age leads to adult target of 25-35g/day by age 20
  - Average US intake is 10-20g/day
  - Include fiber-rich foods in the diet daily
  - Whole grains, fruits, vegetables, nuts

- **What is fiber?**
  - **Dietary fiber**
    - Non-digestible carbohydrates and lignan that is intrinsic and intact in plants
  - **Functional fiber**
    - Isolated non-digestible carbohydrates that have beneficial physiological effects for humans
  - **Total fiber**
    - Dietary fiber + functional fiber

- **A day of fiber consumption**
  - **Goal = 38 grams**
  - | Breakfast | Fiber |
  - |---------|------|
  - | Instant oatmeal, 1 c (2 packets) | 4 g |
  - | Banana, 1 whole | 3 g |
  - | Lunch | Fiber |
  - | Meat sandwich on whole wheat bread | 4 g |
  - | Apple, 1 medium | 3 g |
  - | Carrots, raw, 1 c | 4 g |
  - | Chips | <1 g |
  - | Dinner | Fiber |
  - | Roasted chicken breast | <1 g |
  - | Baked potato, 1 medium | 3 g |
  - | Steamed broccoli, 1 cup | 5 g |
  - | Whole wheat roll | 2 g |
  - | Snacks | Fiber |
  - | Raw almonds, 23 | 4 g |
  - | Popcorn, 3 cups | 3 g |
  - | Strawberries, 1 cup | 3 g |
  - | | 38 g |

* Academy of Nutrition and Dietetics, January 2013
More about ‘functional’ fiber
- Functional fiber is added to increase fiber content of foods
- Fibers isolated and extracted from plant sources and added to food & beverage products to increase fiber content
  - Added during processing/manufacture
  - Makes it much easier to meet daily requirements
- Includes:
  - Inulin- soluble; extracted from chicory root
  - Fiber One products
  - Cellulose- insoluble; extracted from nuts, whole wheat, whole grains
  - Lignan- insoluble; extracted from flax, rye, some vegetables

Fiber and Carb Counting
- Fiber can be subtracted from total carbohydrate if there are ≥ 5 grams/serving
- Applies primarily to insoluble fiber
- Helpful in determining insulin:carb ratios
- Example:
  - 1/2 cup cereal= 24 g CHO, 10 g fiber
  - 24 - 10 = 14 g CHO should be counted
  - That’s a big difference if counting 1:10 g CHO ratio!

Protein Foods in the Diet
- Lean Meats
  - skinless poultry, lean beef, fish, pork
- Low-Fat Diary Products
  - low-fat & fat free cheeses, cottage cheese
  - Milk and yogurt are counted as carbs
- Low-Fat Plant Proteins
  - Tofu, beans, soy-based products
- LEAN MEAT & SUBSTITUTES
  - Beef
    - round steak
    - sirloin steak
    - flank steak
    - tenderloin
  - Pork
    - tenderloin
    - loin or center cut chops
    - ham
    - Canadian bacon
  - Veal
  - Poultry (skinless)
    - chicken
    - turkey
- Fish
  - fresh or frozen
  - canned (in water)
  - shellfish
  - Cheese
    - cottage
    - parmesan (grated)
    - low-fat (< 55 calories per oz)
  - Peanut butter
  - Lunch meat, (95% fat-free)

Dietary Fats
- <30% of total daily calories should come from fat
  - Saturated
    - Should be <10% of total daily calories
    - Trans fat intake should be very minimal
  - Monounsaturated
    - Should be 15-20% of total daily calories
  - Polyunsaturated
    - Should be about 10% of total daily calories

Cholesterol
- Found in foods of animal origin
  - Meats, cheeses, eggs
  - Intake should be <300 mg/day
  - Can raise serum LDL by competing w/ LDL for receptor sites
- High fat, cholesterol diet
  - Increases circulating chylomicrons, contributing to atherogenesis
  - Associated with insulin resistance in DM2
Triglycerides
- Sources can be dietary fats (about 85%), as well as hepatic production from glucose (about 15%)
- To lower TG levels:
  - Improve glycemic control
  - Moderate weight loss
  - Increase physical activity
  - Decrease fat and sugar intake, decrease alcohol consumption
- If >1000mg/dL, acute dietary fat restriction & meds required to lower risk of pancreatitis
  - Fibrates best choice for first line therapy

Saturated Fats
- Raise cholesterol and LDL levels
- Key determinant of LDL levels
- Higher cholesterol intake = higher risk for CVD
- Food sources include animal fats
  - High fat dairy: whole milk, cream, butter, cheeses; fatty meats: brisket, ribs, poultry skin; some processed meats: sausage
  - Coconut oil, palm oil
- Trans fats will increase risk for CVD like SFA
  - TFA found in processed foods such as cookies, snack crackers, chips, dressings, spreads, and prepared desserts

Polyunsaturated Fats
- n-6 or omega-6 and n-3 or omega-3
- n-6 can lower LDL levels and also LDL levels
  - Food sources of n-6 include vegetable oils such as corn oil, soybean oil, sunflower oil, products made from these oils (dressings and spreads)
- n-3 can lower serum TG, antiplatelet clotting effect
  - Food sources of n-3 include salmon, sardines, mackerel, albacore tuna, flax, walnuts

Monounsaturated Fats
- Can lower total and LDL cholesterol without lowering HDL levels
- Low-fat, high CHO diets enriched w/MUFA will improve lipid levels and glucose tolerance
- To lower LDL levels, MUFA should be used to replace SFA and PUFA in the diet
  - BUT, most MUFA is oleic acid, found mostly in SFA sources (meats)
    - So when you lower your SFA intake, you also lower MUFA intake
  - Food sources include canola, olive, or peanut oils, olives, peanuts, almonds, pecans, avocadoes

FATS
1 serving = 5 grams
- Unsaturated:
  - margarine, 1 tsp
  - mayonnaise, 1 tsp
  - cashews, dry roasted, 1 tbsp
  - peanuts, 20
  - almonds, raw, 23
  - olives, 5
  - salad dressing, 1 tbsp
  - avocado, 2 tsp
- Oils, 1 tsp
  - olive
  - peanut
  - canola
  - corn
  - cottonseed
  - safflower
  - soybean
  - sunflower

In Summary...
- Starch, fruit, and milk are carbohydrates that need to be counted.
- Excess intake of sugar alcohols can cause GI upset.
- Non-nutritive sweeteners are a safe, and often better, alternative to real sugar.
- Choosing higher fiber carbs as often as possible improves overall health and wellness, with or without diabetes.
- Lean proteins are lower in fat and calories, and there are many options from which to choose.
- Limiting TG intake can improve fat and cholesterol levels. There are many options from which to choose.
- Replacing SFA and PUFA with MUFA lowers risk for CVD.

All things are ok in moderation!
Helpful Resources

- Academy of Nutrition and Dietetics
  www.eatright.org
- USDA
  www.usda.gov
- Calorie King
  www.calorieking.com
- American Heart Association (website for professionals)
  www.myamericanheart.org/professional/index.jsp
- Institute of Medicine
  www.iom.edu
- National Library of Medicine
  www.nlm.nih.gov
- Choose my plate
  www.choosemyplate.gov

Questions??