Diabetes

Multiple Nutritional Considerations

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About Me

• Employed by UCSF Medical Center since 1990
• Registered Dietitian and Certified Diabetes Educator
  – Adult Diabetes Clinic
  – Diabetes Teaching Center
    • 415-353-2266
  – Diabetes & Pregnancy Program
    • 415-353-2928
  – Madison Clinic: Pediatric Diabetes
    • 415-353-2266
Nutrition:
A key component to managing diabetes

Diabetes is largely self-managed.

Diet + Exercise – the foundations of care

– Associated health issues:
  • Weight control
  • Heart health: lipids and blood pressure
Almost 30 million Americans have Diabetes
- 90-95% have Type 2
≈ 86 million Americans have pre-diabetes
- 35% of adults > 20 y/o
- 50% of adults > 65 y/o

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Pre-diabetes</th>
<th>Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fasting BG</strong></td>
<td>&lt; 100</td>
<td>100 - 125</td>
<td>126</td>
</tr>
<tr>
<td><strong>OGGT</strong></td>
<td>&lt; 140</td>
<td>140 - 199</td>
<td>200</td>
</tr>
<tr>
<td><strong>A1c</strong></td>
<td>&lt; 5.7</td>
<td>5.7 - 6.4</td>
<td>6.5</td>
</tr>
</tbody>
</table>
Many with Type 2 have:

**Metabolic Syndrome**

- **Obesity**
  - Apple Shaped
- **Insulin Resistance**
- **Lipid Abnormalities**
  - High triglycerides
  - Low HDL
  - High LDL
- **Hypertension**
When Weight becomes a Risk
body mass index

BMI (kilograms of weight) divided by (height in meters)^2

<table>
<thead>
<tr>
<th>BMI</th>
<th>Description</th>
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<tbody>
<tr>
<td>&lt; 18.5</td>
<td>Under Weight</td>
</tr>
<tr>
<td>18.5 - 24.9</td>
<td>Normal Weight</td>
</tr>
<tr>
<td>25.0 - 29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>30.0 - 34.9</td>
<td>Grade 1 Obesity</td>
</tr>
<tr>
<td>35.0 - 35.9</td>
<td>Grade 2 Obesity</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>Grade 3 Obesity</td>
</tr>
</tbody>
</table>
Obesity = Insulin Resistance

• 3 of 4 adults with DM are overweight or obese
• Mild to moderate weight, 5-10% of starting weight, and 150 min exercise per week, has been shown to:
  – decrease insulin resistance
  – improve blood glucose control
  – improve blood pressure
  – improve lipids

• Studies such as the Diabetes Prevention Program, support the idea that weight control and exercise can reduce incidence of type 2 diabetes.
Weight Loss Diets

• Most women lose weight on 1200-1500 calories/day
• Most men lose weight on 1500-1800 calories/day
  – When restricting calories may need vitamin mineral supplements

• People can lose weight on various types of diets:
  – Must “burn” more calories than you eat.

• The best diets are individualized and remain balanced and nutritionally sound... and are sustainable long-term!

• 1 pound body fat = 3500 calories
  500 calorie deficit per day x 7 days per week to lose 1 pound
Managing Meals

When you eat, what you eat, and how much you eat... all affect blood glucose levels.

- Aim to eat 3 main meals per day.
- Space meals 4-6 hours apart.
- Consume last meal at least 3 hours before bed.
- Choose healthy snacks.
- Limit sweets and refined grains.

- Don’t skip meals.
  - doing so may result in overeating later in day
  - going long periods without food can lead to hypoglycemia
Blood Glucose

- Blood glucose levels rise after carb meals
- Some glucose is stored in liver and muscles
- Liver releases glucose between meals and overnight to meet needs.
What happens if the liver runs out of glycogen?

If liver glycogen stores fall too low... it must make new glucose from scratch- gluconeogenesis.
Carbohydrate intake, both type and amount, affects BG levels. Digestion → carbs broken down into single sugars and enter bloodstream.
Foods that have Little or No Carbs

• Meat, chicken, fish
• Cheese, cream cheese, cottage cheese
• Cream, half & half
• Eggs, tofu
• Seeds, nuts, nut butters
• Avocado, olives
• Oils, butter, margarine, mayonnaise, sour cream
• Lettuce, cucumbers, celery, radish
• Lemons, limes
Why are Carbs Important

• Provide glucose: body’s main fuel source
• Rich is specific vitamins and minerals
• Source of soluble and insoluble fibers
• Naturally low in saturated fat
ADA Advice

– Carb intake from vegetables, fruits, whole grains, legumes and dairy products should be advised over intake from foods with added fats, sugars, or sodium.

– Avoid sugar sweetened beverages

American Diabetes Association: www.diabetes.org
Click on Professionals section
Click on Standards of Care

Download the new ADA Standards of Care app
## Comparing Macronutrient Targets

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>2015-2020 IOM Dietary Guidelines</th>
<th>Observed average intake for people with diabetes</th>
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</thead>
<tbody>
<tr>
<td>Carbs</td>
<td>45 - 65 %</td>
<td>45 %</td>
</tr>
<tr>
<td>Protein</td>
<td>10 - 35 %</td>
<td>15 - 20 %</td>
</tr>
<tr>
<td>Fat</td>
<td>20 - 35 %</td>
<td>35 - 40 %</td>
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</tbody>
</table>

IOM: institutes of medicine

Diabetes Care, pg. S50 Jan. 2019
## Daily Carb Targets

Based on Estimated Calorie Goals

www.calorieking.com

Tools
Calculators
How many calories should you eat?
Ht  Wt  Gender  Age  Activity

Dietary Reference Intakes (DRI)
For Carbohydrate = 130 g/day.

Food and Nutrition Board Institute of Medicine, National Academy of Sciences

<table>
<thead>
<tr>
<th>Calorie Intakes</th>
<th>40% Carb grams</th>
<th>45% Carb grams</th>
<th>50% Carb grams</th>
<th>55% Carb grams</th>
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<tbody>
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<td>1200</td>
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<td>2400</td>
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<tr>
<td>3000</td>
<td>300</td>
<td>338</td>
<td>375</td>
<td>413</td>
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</tbody>
</table>

Choosing Carb Targets at mealtime

• Women
  – Older or sedentary or controlling portions 30 - 60 g/meal
  – Younger or more active or at healthy weight 60 - 75 g/meal
  – Athletes with high calorie and carb needs 75 - 120 g/meal

• Men
  – Older or sedentary or controlling portions 45 - 75 g/meal
  – Younger or more active or at healthy weight 75 - 90 g/meal
  – Athletes with high calorie and carb needs 90 -150 g/meal
Insulin Dosing

- Type 1 diabetes:
  - Mealtime insulin is dosed based on:
    - **Carbohydrate content of meal**
    - Current BG level
    - Level of physical activity and exercise
### Same dose cannot cover all meals

- **Low carb meal**
  - Omelet: 0 carb
  - Sausages: 0 carb
  - Toast: 15 g carb
  - Butter: 0 carb
  - Coffee: 0 carb

- **High carb meal**
  - Bagel: 60 g carb
  - Banana: 30 g carb
  - Juice: 30 g carb

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4 units too **much** insulin?  
4 units too **little** insulin?
Insulin Timing Matters with 70/30

70/30 = 70% NPH  30% Regular

Rapid-acting blends
- 70/30 Humalog
- 75/25 Novolog
Provide more physiologic coverage for breakfast and dinner, and less cross-over

Lunch: Must eat 4-5 hours after AM injection to match NPH.
Meal times and amount of carbohydrates are FIXED!
NPH lasts all afternoon so may need unwanted snacks.
May get low in middle of night.
Insulin wanes early morning.
Cross-over insulin action increases risk of hypoglycemia.
Balancing Calories

- Enjoy food, but eat less
- Avoid oversized portions

Foods to Increase

- Make half your plate fruits and vegetables
- Make at least half your grains whole grains
- Switch to fat-free or low fat (1%) milk

Foods to Reduce

- Eat less sodium
- Drink water instead of sugary drinks
Alternate Plate Model

- **Vegetables and Salad**: No limit
- **Protein**: Size of palm of your hand
- **Starch**: 1 cup, or Size of Fist
- **Fruit**: Size of Tennis Ball
  - With meal or later as snack
- **Milk or Yogurt**: 1 cup
  - Optional
Portion Control: Serving Size Suggestions

- **Starch**: Size of clenched fist
- **Protein**: Size of palm
- **Fruit**: Size of cupped hand
- **Fat**: Size of thumb
- **Vegetables and Salad**: Size of both hands cupped
Carb Counting Tools

• Food labels
• Food composition tables
• Carb counting books
  – Diabetes and Carb Counting For Dummies -by Sherri Shafer
• Fast food and chain restaurant brochures and websites
• Websites
  – calorieking.com  - food database for looking up nutrition info
  – deo.ucsf.edu - UCSF diabetes education online
• Apps
  – Calorie King: food search engine, BMI and calorie calculators
  – My Fitness Pal: food search engine and tracker
  – KingFit: 4 diabetes experts with dozens of 5-10 min video lessons
**Nutrition Facts**

**Serving Size**: 2/3 cup (55g)

**Serving Per Container**: About 8

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th>Calories 230</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat 8g</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>Saturated Fat 1g</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Trans Fat 0g</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Sodium 160mg</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>37g</td>
<td>12%</td>
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<tr>
<td>Dietary Fiber 4g</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Sugars 1g</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Protein 3g</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>

| Vitamin A          | 10%          |
| Vitamin C          | 8%           |
| Calcium            | 20%          |
| Iron               | 45%          |

*Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs.

**Calories**: 230

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<tr>
<td>Total Carbohydrate</td>
<td>37g</td>
</tr>
<tr>
<td>Dietary Fiber 4g</td>
<td>14%</td>
</tr>
<tr>
<td>Sugars 1g</td>
<td>2%</td>
</tr>
<tr>
<td>Protein 3g</td>
<td>10%</td>
</tr>
</tbody>
</table>

| Vitamin D 2mcg     | 10%          |
| Calcium            | 260mg        | 20%            |
| Iron               | 8mg          | 45%            |

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.
Food Labels

First check **Serving Size**

Next check grams of **Total Carbohydrate**

- The **Total Carbohydrate** includes:
  - Fiber, sugar, starches, other carbs

- **Total Sugars** includes added & natural but the amount of **Added Sugar** is now noted.

---

**Nutrition Facts**

10 servings per container

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>6 crackers (30g)</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
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</tr>
<tr>
<td>% Daily Value</td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>6g</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>1g</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>0g</td>
</tr>
<tr>
<td>Cholesterol</td>
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</tr>
<tr>
<td>Sodium</td>
<td>490mg</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>30g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>3g</td>
</tr>
<tr>
<td>Total Sugars</td>
<td>5g</td>
</tr>
<tr>
<td>Includes 2g Added Sugars</td>
<td>3%</td>
</tr>
<tr>
<td>Protein</td>
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</tr>
<tr>
<td>Vitamin D</td>
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</tr>
<tr>
<td>Calcium</td>
<td>30 mg</td>
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<tr>
<td>Iron</td>
<td>8 mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>235 mg</td>
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</table>
Fiber is non-digestible...but should you bother to subtract it?

Subtract fiber if doing so changes the insulin dose calculation.

This tortilla ↑ has just 3 grams of digestible carb after subtracting the fiber.
Carb Counting Lists
Each example ≈ 15 g Carb

1 cup milk
½ cup potatoes, corn, peas, legumes, oatmeal
⅓ cup cooked rice, pasta, millet, quinoa, stuffing
1 slice bread
1 small tortilla, ⅓ large tortilla
½ hamburger bun, ½ pita bread, ¼ bagel
3 cups popcorn
1 cup cantaloupe, papaya, raspberries
1 “small” apple, orange, banana, 4 oz fruit juice
Non-Starchy Vegetables

• ½ cup cooked ≈ 5 g carb

Asparagus, beets, broccoli, cabbage, carrots, cauliflower, eggplant, green beans, mushrooms, onions, pea pods, peppers, spinach, tomatoes, zucchini

Less carbs, but can be significant for T1DM dosing.
Vegetables: to count or not to count

• Example 1:
  – Liz has type 1 diabetes: her insulin:carb ratio 1:5
    • 1 unit rapid acting insulin for every 5 g carb
  – She eats 2 cups veggies
    • 1/2 cup cooked = 5 g carb
    • 2 cups cooked = 20 g carb
    • 1:5 ratio so needs 4 units of insulin
      – If she doesn’t count the carbs in vegetables she is under-dosing by 4 units → hyperglycemic
Vegetables: to count or not to count

• Example 2:
  – Ed has type 1 diabetes, his insulin:carb ratio 1:20
    • 1 unit rapid acting insulin for every 20 g carb
  – He eats ½ cup veggies
    • 1/2 cup cooked = 5 g carb
    • 1:20 ratio so needs ¼ unit of insulin
      – Insignificant; with syringe cannot be measured
      – With a pump 0.25 units can be delivered but is likely not going cause hyperglycemia if the ½ cup vegetables is not dosed for.
Variables affecting digestion times

Normally BG peak is about 1-2 hours post meal

Exceptions:
• Liquid carbs: fastest
• Highly refined grains: fast
• High fiber foods: slower
• High fat, fried: slowest
Avoid Liquid Sugar: rapid absorption and BG rise

American Diabetes Association guidelines:
Avoid sugar-sweetened beverages
Refined vs Whole Grains

Blood Glucose Profiles After Eating
- Refined carbs usually cause a sharper rise in blood glucose.
- Whole grains take longer to digest so may result lower BG rise.
Insulin Timing Matters: High Fat Meals

Graphs show mismatch in timing between rapid-acting insulin and delayed BG rise after eating a high fat meal.

Rapid acting mealtime insulins peak in 30-90 min
Risk: insulin quick + digestion slow = hypoglycemia

High fat meals digest slowly
Risk: insulin waning = hyperglycemia

Glucose from the meal

Hours Post Eating → 1 2 3 4 5 6 7 8

Relative Concentrations

Insulin action

Solutions?

Pump users can use the combo bolus to deliver insulin slowly in pulses over time.
Injection users can eat first and inject mid- to end of meal to give food a head start.
Insulin Timing Matters: Liquid Carbs

Digestion liquid carbs: 15 minutes
- Absorbed before insulin peak
- Initial risk hyperglycemia

Rapid Acting Insulin duration: 4 hours
- Outlasts the liquid carb digestion
- Later risk hypoglycemia

Hours Post Eating → 1 2 3 4 5 6 7 8
## Nonnutritive Sweeteners

<table>
<thead>
<tr>
<th>Type of sweetener</th>
<th>Product names</th>
<th>FDA approved</th>
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</thead>
<tbody>
<tr>
<td>Saccharin</td>
<td>Sweet’N Low</td>
<td>These do not raise blood glucose and do not contribute calories.</td>
</tr>
<tr>
<td></td>
<td>Sweet Twin</td>
<td></td>
</tr>
<tr>
<td>Aspartame</td>
<td>NutraSweet</td>
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<tr>
<td></td>
<td>Equal</td>
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<tr>
<td>Acesulfame-K</td>
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<tr>
<td>Stevia</td>
<td>Truvia</td>
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Position paper on sweeteners from the [Academy of Nutrition & Dietetics](https://www.andeat.org/vault/2440/web/JADA_NNS.pdf)

Nonnutritive Sweeteners: Current Use and Health Perspectives [ADA, AHA](http://care.diabetesjournals.org/content/35/8/1798.full)
Sugar Alcohol

• Products can claim: **Sugar-Free**
• Still is carbohydrate- oxygen + hydrogen added
• Slower absorption: less effect on BG
• Some cause gas, laxative effect

**Sorbitol, Mannitol,**
Maltitol, Isomalt, Xylitol,
Lactitol, Erythritol,
Hydrogenated Starch Hydrolysates
Beware Labeling

Sugar-Free Candy

No-Sugar-Added Ice Cream
Skewing a Balanced Diet

– Some people continually respond to elevated BG by restricting healthy carb containing foods.
  • Example: if pre-meal high BG, parent might give water instead of milk, or withhold fruit.
  • To avoid injecting for snacks, people may rely on high saturated fat snacks like salami or cheese.

– Some people might think giving more insulin must be “bad” so they restrict carbs in the diet.

– What are the long-term health implications of restricting healthy carb-containing foods?
Look for Leaner Meats and Proteins

<table>
<thead>
<tr>
<th>Lean</th>
<th>Medium Fat</th>
<th>High Fat</th>
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<tbody>
<tr>
<td>0-3 grams of fat per ounce</td>
<td>4-7 grams of fat per ounce</td>
<td>≥ 8 grams of fat per ounce</td>
</tr>
<tr>
<td>Beef: sirloin, tenderloin, flank, round Pork: tenderloin, ham, Canadian bacon</td>
<td>Beef: corned beef, ground Pork: cutlet, shoulder roast Lamb: ground, rib roast Poultry with skin on Fried fish</td>
<td>Bacon Sausages Salami Pork spareribs Bratwurst</td>
</tr>
<tr>
<td>Skinless Poultry Fish and Shellfish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low fat hot dogs Low fat cheeses Egg whites</td>
<td>Medium fat hot dogs Reduced fat 2% cheeses Mozzarella and ricotta Eggs</td>
<td>Hot dogs Cheeses: cheddar, Swiss, Jack, Colby, Brie, Bleu</td>
</tr>
</tbody>
</table>

Or opt for vegetarian meat substitutes such as: vegetarian hot dogs, burgers, and sausages.
6 oz Lean versus High Fat Meat

- Lean Meats
  45 kcal/oz  0-3 g fat/oz
  - Pork Tenderloin
  - Ham, Canadian Bacon
  - Sirloin Steak
  - Flank Steak
  - Lamb Chop
  - Poultry
  - Salmon
  6 oz = 270 calories
  \( \leq \) 18 grams fat

- High Fat Proteins
  100 kcal/oz  \( \geq \) 8 g fat/oz
  - Ribs
  - Sausage
  - Bacon
  - Salami
  - Bologna
  - Hot Dog
  - Cheese
  6 oz = 600 calories
  \( \geq \) 48 grams fat
## Rec’d Fat Gram Budgets

Institutes of Medicine

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<thead>
<tr>
<th>Calorie Level</th>
<th>20-35% kcals total fat grams</th>
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<td>2400</td>
<td>53 - 93</td>
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<td>2600</td>
<td>57 - 101</td>
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## Fast Food is Often Fat Food

<table>
<thead>
<tr>
<th>Item</th>
<th>Grams of fat</th>
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<tbody>
<tr>
<td>Deluxe Cheese Burger</td>
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</tr>
<tr>
<td>French fries, large order</td>
<td>25</td>
</tr>
<tr>
<td>16 ounce chocolate shake</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100 g</strong></td>
</tr>
</tbody>
</table>
Trimming Calories

- Limit fast food dining
- Use lean proteins *0-3 g fat/oz*
- Choose low fat dairy products *0-3 g fat/serving*
- Use added fats in moderation *butter, margarine, mayo*
- Cook in a low fat method *not fried*
- Opt for low calorie beverages *limit alcohol*
- Use plate model of portioning or hand method.
Lipid Targets with Diabetes

Serum Lipid Goals (mg/dl):
- Total Cholesterol < 200
- Triglycerides < 150
- LDL Cholesterol < 100
- < 70 if multiple risk factors
- HDL Cholesterol > 40 for men
  > 50 for women
Lipid Management

• Weight loss – if overweight
• Exercise
• Reduce saturated, hydrogenated, and trans fats
• Increase soluble fiber
• For elevated triglycerides
  – Optimize blood glucose control
  – Limit sweets, refined grains, and alcohol
  – Include Omega 3 fats
Check the Label for Fat

- Check the grams and types of fat
  - Low Total Fat 0-3 grams
  - Low in Saturated Fat 0-1 gram
  - Goal is 0 grams of Trans Fat

Warning:
Label can say 0 grams if < 0.5 g
- under ½ gram per serving

Check ingredients list: hydrogenated oils indicate risk of trans fats.
# Quick Tips to Identify Fats

<table>
<thead>
<tr>
<th>Heart ♥ Healthy Fats + Oils</th>
<th>Not So Heart Healthy Fats + Oils</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Usually liquid at room temperature</td>
<td>✓ Usually solid at room temperature</td>
</tr>
<tr>
<td>✓ Typically from plant sources</td>
<td>✓ Typically from animal sources – meat fats, dairy fats</td>
</tr>
</tbody>
</table>
# Types of Dietary Fats

<table>
<thead>
<tr>
<th>Monounsaturated</th>
<th>Polyunsaturated</th>
<th>Limit Saturated Fats &amp; Hydrogenated Fats</th>
</tr>
</thead>
<tbody>
<tr>
<td>♥ ♥ ♥ ♥ ♥ Heart Healthy</td>
<td>♥ ♥ ♥ ♥ ♥ Heart Healthy</td>
<td></td>
</tr>
<tr>
<td><strong>Vegetable Oils:</strong> olive oil, canola oil, peanut oil</td>
<td><strong>Vegetable Oils:</strong> safflower, corn, sesame, almond, sunflower oils</td>
<td><strong>Animal Fats:</strong> butter, lard, cheese, cream, chicken skin, sour cream, bacon, half &amp; half, meat fats</td>
</tr>
<tr>
<td><strong>Others:</strong> avocados, peanuts</td>
<td><strong>Omega 3 Fats:</strong> fresh fish, fish oil supplements, flax seeds, walnuts, soy products, tofu, canola oil, flax oil</td>
<td><strong>Solid Fats:</strong> margarine, shortening</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Tropical Oils</strong></td>
</tr>
</tbody>
</table>
Include Soluble Fiber

- Soluble fiber binds bile acids.
- Instead of being reabsorbed by the terminal ileum, bile acids are excreted.
- The body must make new bile acids out of circulating cholesterol.

Soluble Fiber Sources:
- cereal grains, oatmeal, rice bran, legumes, barley, papayas, citrus fruit, strawberries...
- and soluble fiber supplements, psyllium
Bile helps with digestion + absorption of dietary fat.

Bile enters upper intestine

Bile transported back to liver and reused

Bile gets stuck in Soluble Fiber and is eliminated - as fiber is non-digestible. Losing bile in this way means more bile is made out of cholesterol.

Consuming soluble fiber helps to lower cholesterol.
Managing High Triglycerides

- Limit intake of fats
  - Reduce intake monounsaturated fats
  - Reduce intake of polyunsaturated fats
  - Reduce intake of saturated, trans, and hydrogenated fat
- Limit sweets and refined grains
- Limit alcohol
- Weight control and Blood Glucose control
- Add omega 3 fats
- Add medications if needed
Fructose is processed in the liver...

**Excess intakes** of:
- high fructose corn syrup or
- sucrose- “white sugar”

Can increase triglycerides, and contribute to fatty liver

Eat fresh fruits, one serving at a time but limit fruit juices.
Hypertension Management

- Blood Pressure target for DM 140/90 mmHg, or less.

- Blood pressure lowering tips
  - Weight Loss
  - Exercise
  - Limiting Alcohol
  - Avoiding Smoking
  - Limiting Sodium < 2,300 mg/d (or less)
    - American Heart Association rec < 1500 mg/day if
      - HTN, DM, kidney disease, or over age 51

- Blood Pressure Medications
Limit Sodium

- Use herbs, spices, pepper, salt-free seasoning.
- Limit cured meats and pickled products.
- Cut back on fast-foods and processed foods.

- Read labels look for
  - no-salt-added
  - low sodium

<table>
<thead>
<tr>
<th>KEY</th>
<th>Low Sodium</th>
<th>High Sodium</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value</td>
<td>5% or less</td>
<td>20% or more</td>
</tr>
<tr>
<td>mg Sodium</td>
<td>140 mg or less</td>
<td>400 mg or more</td>
</tr>
</tbody>
</table>

**Nutrition Facts**

<table>
<thead>
<tr>
<th>Serving size</th>
<th>2/3 cup (55g)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Amount per serving</th>
<th>Calories 230</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>% Daily Value*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat</td>
<td>8g</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>1g</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>0g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>0mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>160mg</td>
</tr>
</tbody>
</table>

| Total Carbohydrate  | 37g           |
| Total Sugars       | 12g           |
| Includes 10g Added Sugars | 20%         |
| Protein            | 3g            |
What about supplements?

• Vitamins, minerals, herbal products, and cinnamon, are marketed to people with DM:
  – but are not rec’d by ADA due to lack of scientific evidence demonstrating actual benefit.
  – Routine use of antioxidant supplements are not rec’d due to lack of evidence of efficacy and concerns regarding long-term safety.
  – Multi-vitamin-minerals supplement are recommended for pregnancy, vegetarians, elderly, low calorie diets, or those with unbalanced diets.

Supplements are not regulated by the FDA
Case Study: Bob

- 55 y/o male with type 2 DM for 5 years
- Ht: 5’9” Wt: 205 #  BMI 30
- LDL 124, HDL 23, Trig 279
- BP 144/94
- Sedentary
- Lives alone
- Low Literacy
- English is second language
- Scheduled appt because “his doctor said to…”
- Hasn’t been SMBG, no recent A1c
Case Study Bob:
Assessment

- Problems:
  T2DM, Grade 1 obesity, HTN, ↑ LDL, inactive

- Barriers to learning:
  ↓ low literacy, ESL, lives alone
Case Study Bob: Plan

- Prioritize!
- Simple instructions, don’t overwhelm
- Try to split info into multiple visits
- Prescriptions likely for lipids, BG, HTN
- RD consult and learning to monitor BG
  - weight loss, exercise
  - carb control: plate model, hand model
  - teach basic healthy food choices, lean
Alcohol Increases Risk of Hypoglycemia

Available glucose:
- from carbs digesting
- Glucose from Liver

Liver provides glucose until the next meal is eaten: glycogenolysis and gluconeogenesis.

Hepatocytes oxidize ethanol $\rightarrow$ acetaldehyde

Disposal of excess NADH blocks other metabolic pathways which can lead to synthesis of lipids and raise triglycerides. It also impairs gluconeogenesis.

Exogenously administered insulin keeps pushing BG down despite falling serum glucose levels, whereas a functioning pancreas would reduce insulin production.
Carbs in Alcohol?

Hard liquor = 0 carbs

Wine = 3 g carb

12 oz beer = 13 g carbs

Mixed drinks can have significant amounts of carb
Recommended Limits on Alcohol

• If an adult with DM chooses to drink alcohol, they should be advised to drink in moderation:
  – Women: up to 1 drink per day
  – Men: up to 2 drinks per day

• What counts as a drink?
  – 12 oz beer
  – 5 oz wine
  – 1½ oz hard liquor

Don’t drink on an empty stomach
When do people tend to drink?

• Older generation:
  – Pre-dinner cocktail
    • What if lunch was 5-6 hours ago?

• Younger generation:
  – Late at night, parties, clubs, bars
    • How many hours since dinner?
    • How many drinks...
      – and how many hours will gluconeogenesis be impaired?
    • If stumbling will other people assume intoxication?
    • What happens during sleep? Risk: severe nocturnal hypo’s.
Treating Hypoglycemia

• BG below 70 mg/dl
  – take 15-20 grams of carbohydrate
    (young kids likely need less, such as 5-10 grams)
    • 4 oz juice or regular soda
    • 1 Tbsp sugar, jam, honey
    • 4 glucose tabs
  – recheck BG in 15-20 minutes
  – repeat as needed
  – BG below 50 mg/dl or low after exercise?
    • Likely need even more carbs to treat the initial low.
Consider Insulin on Board
When treating lows

Are you low when your insulin is peaking, or when the insulin levels are lower?

Consider the times hypoglycemia could occur as indicated by the two arrows above. Which would take more carbohydrate to resolve the hypoglycemia?
Exercise for Type 2 Diabetes
A foundation treatment strategy

• Exercise
  – Decreases insulin resistance
  – Increases muscles’ glucose uptake
  – Helps with weight management
  – Improves lipids: ↓ LDL  ↓ trig  ↑ HDL
  – Improves cardiovascular fitness
  – Improves blood pressure
  – Reduces stress, enhances quality of life
  – It can be as simple as walking regularly
Exercise Prescription

• Aerobic Exercise
  – walking, rowing, cycling, swimming, low impact aerobics, armchair exercises
    • moderate level at least 150 minutes per week
    • not more than 2 consecutive days without exercise

• Resistance Exercise
  – 2 or more times per week

• Limit sedentary time. Move around after every 90 minutes of sitting.
Exercising with Limited Mobility

• Most individuals can find some form of exercise that is suitable for them.

• Upper body exercises
  – Chair exercise home videos are available

• Some pools offer services for handicapped

• Stationary cycling or rowing machines

• Intermittent is fine: 5-10 min at a time
Fluid Requirements

• Elevated BG increases risk for dehydration
  – Kidneys excrete glucose in urine

• Exercise further increases fluid needs
  – Especially in hot climates

• Drink plenty of fluid
  – Choose water or other
  – Reserve juice for preventing and treating hypoglycemia
Exercise Safely

• Check BG
  – keep meter and supplies handy

• Hypoglycemia
  – may need to reduce insulin doses
  – carry carbs

• Hydration
  – heat, perspiration, high BG: ↑ fluid needs

• Foot care
  – wear proper shoes & socks
  – visually inspect feet every day
  – avoid pounding & jumping if loss of sensation

• Medical ID
Case Study
Exercise

• Suggestions for an exercise routine for a 63 y/o female with 20 year history T2DM
  – Complains of tingling and numbness in her feet
  – Family history heart disease
  – BMI 41 – grade 3 obesity
  – Blood Pressure 152/94
Exercise with Peripheral Neuropathy

Discuss exercise benefits: weight, BG, BP, lipids
- Consider body weight and abilities.
- Start with 5 minutes, or what she will agree to and increase over time.
- Discuss ideas and options that appeal to her.
- Consider exercise logs and setting goals with rewards.

– **Avoid:** jogging, stair-master, stair exercises, jumping, prolonged walking, treadmill, and heavy weight bearing exercises.

– **Suggested:** swimming, bicycling, rowing, chair exercises and other non-weight bearing exercise.
Kids get type 2, too
Screening Children for T2DM

• Who to screen:
  – Kids who are overweight, >85% weight for height
  – and have at least 1 risk factors for T2DM
    • Family history, high risk ethnic group, HTN, acanthosis, dyslipidemia, PCOS
    • Was small for gestational age, or mom had GDM

• When:
  – Starting at age 10
  – or at puberty if it occurs before age 10

• How Often:
  – At least every 3 years
Healthy Tips for Healthy Kids

• balanced meals, appropriate snacks
• 5 servings/day from fruits & vegetables
• lean meats, low fat dairy products
• limit fats and fried foods
• fewer fast food meals
• reduce or avoid juices, avoid soft drinks
• healthy snacks
• Exercise:
  – aerobic: 30-60 min/day ≥ 5 d/wk
  – strength training ≥ 3 d/wk
  – limit screen time and sedentary behaviors
Review

• Diet and Exercise = foundation treatment in diabetes.
• Weight loss goal: 5-10% of starting weight if overweight
• While carb counting isn’t always imperative for T2DM, carb portion control is. Type 1’s should carb count.
• Simple strategies such as portion control, carbohydrate distribution, and avoidance of liquid concentrated sweets will significantly improve BG control.
• T2DM runs in families: get screened.
• Diabetes is largely self-managed: learn how to do so.
Thank You

Questions?