OBJECTIVES: CARBOHYDRATE COUNTING IN THE REAL WORLD

- Present healthy eating strategies
- Review Basic Carbohydrate Counting
- Discuss Advanced Carbohydrate Counting
- Review ways to improve portion estimation and carbohydrate counting when eating out
- Review label reading techniques
- How to use these tools in the REAL WORLD!
Children with diabetes have the same nutritional needs as children without diabetes.
Less than 50% of participants met recommendations for fat, Vitamin E, fruit, vegetables and grains.

Authors felt that there was a critical need for improvement of dietary intake in youth with diabetes.

**Journal of the American Dietetic Association (May 2006)**
Most of the 128 participants had inadequate levels of vitamin D

- 24% sufficient
- 61% insufficient
- 15% deficiency

***The Journal of Pediatrics Jan 2009
FOOD GUIDE MESSAGE

- Enjoy a variety of foods from each group every day
- Choose lower fat foods more often
- Choose whole grains and enriched products more often
- Choose dark green or orange vegetables and orange fruit more often
- Choose lower fat milk products more often
- Choose leaner meats, poultry and fish, as well as dried peas, beans and lentils more often
FOOD GROUPS CONTAINING CARBOHYDRATE

- Grains, Beans and Starchy Vegetables
- Fruit
- Milk and Yogurt Products
- Sweets
- Non Starch Vegetables
HOW TO GET KIDS TO EAT HEALTHY?

- Kids learn from their parents
- Offer healthy and convenient snacks
- Create colorful meals and snacks
“How come God put all the vitamins in cabbage and nothing in candy?”
More liberalized Meal Planning (Carb Counting), analog insulin, insulin pump therapy can allow for an INCREASE IN FOOD CHOICES, BUT...demands attention to

- PORTION SIZES

- ACCURATE CARB COUNTING
**WHY COUNT CARBS?**

- Carbohydrates raise blood glucose levels quicker and higher than Fat or Protein.

- Within 1 to 2 hours most of the carbohydrate we eat has been converted into glucose.

- Balancing Carbohydrate intake with insulin and exercise helps to keep blood glucose levels in your target range.
In a recent Italian study published in May of this year it was shown that Counting Carbohydrate as part of your Diabetes Management Program can actually improve Quality of Life along with knowledge of Diabetes Management.

*Trento, Marina et al. Journal Endocrinol Invest May 3, 2010*
Uses “Carb Choices”

Carb Choices are based on exchanges

1 exchange/choice = 15 grams of carb
- 1 fruit = 1 starch = 1 milk = 1 other

Vegetables are free when only 1 or 2 servings are eaten at a time

This system is based on averages and not precise
**ADVANCED CARBOHYDRATE COUNTING**

- Count exact carb grams in the food rather than exchanges or choices
- *More precise than using exchanges*
- *Best way to match insulin doses to food*
- *Accuracy of insulin dose is influenced by the accuracy of your carbohydrate counting*
**INSULIN TO CARBOHYDRATE RATIO**

- This is the amount of insulin to cover the carbohydrate eaten at a meal or snack.

- When set correctly the BG should not rise more than 2.2 - 4.4 mmol at the 2hr pc mark.

- When adjusting do so by 1 to 2 grams at a time.
Detailed food, BG and insulin dose records are helpful.

Accurate carbohydrate counting is essential.

BG testing ac and 2 hr and 4 hr pc meals.

There are three methods that can be used.
**METHOD ONE: FOOD RECORDS**

- Keep detailed BG, insulin & food records
- Divide grams of carb consumed by insulin dose taken
- This helps to identify the differences in I:C ratios at different meals
- **DISADVANTAGE:** the I:C ratios on MDI will be different than on a pump
Insulin to Carb ratio is the amount of carbohydrate 1 unit of insulin will cover.

It is a precise way to calculate your insulin needs based on your carbohydrate intake.

\[ I:C = \frac{500}{TDD} \]

*TDD is the Total Daily Insulin Dose

E.g. \( I:C = \frac{500}{20} \)

1 unit for every 25 grams of carb
Take the TDD - basal insulin = bolus insulin

Divide the daily average carbohydrate intake by the bolus insulin to = I:C ratio
- E.g.. Becky’s TDD is 20 units - 10 units basal = 10 units bolus

Average CHO intake of 220 g per day = 22 g
10 units
## Carb Grams vs. Choices

<table>
<thead>
<tr>
<th>FOOD</th>
<th>GRAM</th>
<th>VS CHOICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cup mashed potatoes</td>
<td>36</td>
<td>2</td>
</tr>
<tr>
<td>8 spears of asparagus</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1 small dinner roll (1 oz.)</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>3 oz of chicken</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 small 8 oz pear</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>2 tsp margarine</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>81 gm</td>
<td>60 gm</td>
</tr>
</tbody>
</table>

**Insulin dose using 1:15 (1:C ratio)**  
5.4 u vs 4.0 u
"...Doctor, I have Billy Roberts on line two who wants to konw how much insulin he needs to take to cover 6 malt balls...3 chocolate bunnies...11 marshmallow eggs... oh... and a whole handful of gummi worms..."
2009 study found that only 23% of adolescents (ages 12-18yrs) estimated daily carbohydrates within 10 grams of the true amount.

*** Diabetes Spectrum Jan,1 2009 Vol 22,#1
HOW TO CARB COUNT ACCURATELY

- Read and use labels
- Software on pumps for carb information
- Ask for nutrition information at restaurants
- Look up information on-line before going
  - (www.calorieking.com)
- Divide and Conquer: Order rice or pasta on side rather than mixed with other foods in casseroles
Use the Nutrition Facts Labels to help you make informed choices.

Not all foods have labels. Exceptions: fresh fruit and vegetables, raw meat and poultry, foods prepared or processed at the store, foods that contain very few nutrients.

Canada introduced a new system for providing nutrition information on food labels in 2003.

As of Dec 2005, most companies are required to provide accurate food labels to consumers.
PORTIONS VS. SERVINGS
WHAT’S THE DIFFERENCE?

A SERVING is the amount of food you see listed on the Nutrition Facts Label or what is recommended for the different food groups on the Food Guide.

A PORTION is the amount of food you choose to put on your plate.

PORTIONS may actually contain several SERVINGS.
WHY IS PORTION CONTROL AND ACCURATE CARB COUNTING IMPORTANT?

- Optimal postprandial blood sugar control
- Weight management
HOW TO PORTION ACCURATELY

- Measuring Tools
  - Measuring cups
  - Measuring spoons
  - Gram scales, Salter Scale
- Food Labels
- Exchange Lists, Internet, Books: Calorie King
WHAT IS A SERVING???
TIPS AND TRICKS

- Thumb tip = 1 tsp (mayo or margarine)
- Thumb = 1 Tbsp (salad dressing, cream cheese)
- Two fingers lengthwise = 1 ounce (cheese or meat)
- Palm of hand/deck of cards = 3 ounces (meat)
- Tight fist = ½ cup (noodles or rice)
- Cupped hand = 1 cup (vegetables or rice)
  - Woman’s hand sizes
Look at the specific amount of food listed

Compare this to the amount you plan on eating

If the amounts are different, do the math to calculate the correct nutrition information
Although the gram weight is the same in both, the serving size is different.
**Per 1/12 package (83 g) (about 1/12 cake)**

<table>
<thead>
<tr>
<th>Amount</th>
<th>Dry Mix</th>
<th>Original Recipe</th>
<th>Lower Fat Recipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>170</td>
<td>270</td>
<td>190</td>
</tr>
<tr>
<td>% Daily Value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat 4.5 g*</td>
<td>7 %</td>
<td>23 %</td>
<td>9 %</td>
</tr>
<tr>
<td>Saturated 2 g+ Trans 0.5 g</td>
<td>13 %</td>
<td>18 %</td>
<td>13 %</td>
</tr>
<tr>
<td>Cholesterol 0 mg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium 370 mg</td>
<td>15 %</td>
<td>15 %</td>
<td>15 %</td>
</tr>
<tr>
<td>Carbohydrate 33 g</td>
<td>11 %</td>
<td>11 %</td>
<td>11 %</td>
</tr>
<tr>
<td>Fibre 2 g</td>
<td>8 %</td>
<td>8 %</td>
<td>8 %</td>
</tr>
<tr>
<td>Sugars 20 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein 2 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A</td>
<td>6 %</td>
<td>6 %</td>
<td>6 %</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>0 %</td>
<td>0 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Calcium</td>
<td>6 %</td>
<td>6 %</td>
<td>6 %</td>
</tr>
<tr>
<td>Iron</td>
<td>15 %</td>
<td>15 %</td>
<td>15 %</td>
</tr>
</tbody>
</table>

**Label Reading:**

Different preparation methods can change nutrient content.
o Look at the fat content.

o Compare the listed fats (saturated and trans fats) with the remaining unlisted fats (polyunsaturated and monounsaturated fats)

o A good goal is to have more than 50% of total fat coming from polyunsaturated and monounsaturated fats
is a benchmark for evaluating the nutrient content of foods quickly and easily
is based on recommendations for a healthy diet
is used to determine whether there is a lot or a little of a nutrient in a specific amount of food
According to the Canadian Diabetes Association, fiber does NOT raise blood glucose and therefore should be subtracted from the total carbohydrate.

According to the American Diabetes Association only half of the fiber grams should be subtracted once you get over 5 grams.
SORBITOL, XYLITOL, MANNITOL, ISOMALT

Often have an “ol” ending

These sugars have less of an affect on the blood glucose results as they are not completely absorbed in the body

Large amounts can create a laxative affect

IF A FOOD ITEM CONTAINS 5GM OF SUGAR ALCOHOL THEN SUBTRACT HAVE OF THOSE GRAMS FROM THE TOTAL CARBOHYDRATE AND ONLY COUNT THE DIFFERENCE
ALCOHOL

- ALCOHOL ITSELF DOES NOT CONTAIN CARBOHYDRATE
- HOWEVER SOME ALCOHOLIC BEVERAGES LIKE BEER AND COOLERS DO CONTAIN CARBOHYDRATE
- ALCOHOL CAN LOWER THE BLOOD SUGARS
- IT IS A GOOD IDEA TO ALWAYS EAT WHEN CONSUMING ALCOHOL

ADA RECOMMENDS:
- NO MORE THAN 2 DRINKS PER DAY FOR MEN
- NO MORE THAN 1 DRINK PER DAY FOR WOMEN
GLYCEMIC INDEX

IS A SYSTEM THAT RANKS CARBOHYDRATE CONTAINING FOODS BASED ON THEIR POTENTIAL TO IMPACT BLOOD GLUCOSE RESULTS

- Foods are given a rating between 1-100
- Every food is compared to glucose with a rank of 100
- The higher the rating the higher the potential rise in blood glucose
Once portion sizes and carbohydrate counts are known for food and beverages at home, then eating out is easier.

Careful postprandial blood glucose monitoring will tell you if you estimated portions accurately, correct with additional insulin if needed.
Can help deliver the insulin to match the carbohydrate absorption more closely

AND

Help to improve glycemic control
NORMAL BOLUS

Duration of insulin delivery

Total Dosage

2 u

4 u

6 u

1 hr

2 hr

3 hr

2 u

4 u

6 u
EXTENDED BOLUS

- Can be used when a determined amount of carbohydrate is going to be consumed over a certain amount of time

- Cocktail parties
- Buffets
- Low glycemic index foods

- You can calculate the total amount of insulin and deliver it over a 3-hour period for example
EXTENDED BOLUS

- Duration of Delivery:
  - 1 hr
  - 2 hr
  - 3 hr

- Total Dosage:
  - 2 u
  - 4 u
  - 6 u
Can be used to deal with the affect that Protein and Fat can have on blood glucose results
FAT

- Effects on BG
  - Delayed stomach emptying
  - Decreased insulin sensitivity
  - Increased insulin resistance
  - May last for hours after eating
- Minimal fat actually converted to glucose (<10%)
- Individual’s response needs to be evaluated


May need to increase insulin for a high fat meal
- 1-2 units for a meal with 10-20 g fat
- Up to 4 units for a meal with greater than 20 g fat
- Varies based on patient’s total daily dose of insulin

May need to use the extended bolus for a high fat meal to accommodate delayed absorption of CHO
- Start with a 50/50 bolus
  - 50% given as a normal bolus
  - 50% extended for 2 hours
- Adjust based on individual’s response


Many Canadians eat double the recommended amounts for protein.

Rate of digestion and conversion to glucose depends on state of insulinization and glycemic control.

BG effect difficult to predict
- Up to 50-60% can be converted to glucose.

Evidence suggests more glycemic impact in poorly controlled diabetes, less impact when patient is adequately insulinized and controlled.

In individuals without diabetes:
- Protein ingestion stimulates the endogenous production of both insulin and glucagon

In individuals with type 1 diabetes:
- No endogenous insulin production
- Production of endogenous glucagon
- Protein causes a slow rise in BG; 3-5 hours after eating
  - Occurs after the peak of rapid-acting insulin analogs
  - Cannot be included in meal bolus

Nutall FQ et al. 1984
Small to moderate protein intake has little effect on BG
  - Combo bolus is not needed

Large protein intake (greater than 8 oz)
  - BG may increase 4-12 hours later
  - Combo bolus may be beneficial
  - Duration and dosage based on individual’s response
  - Consider temporary basal increase starting 3-4 hours after the meal

How can we adjust the bolus to deal with these affects?

- COMBO BOLUS OPTION

AN EXAMPLE:

- CAN DELIVER 50% OF THE TOTAL AMOUNT OF INSULIN AS A NORMAL BOLUS AND THE OTHER 50% OVER AN EXTENDED AMOUNT OF TIME
COMBO BOLUS

Duration of Delivery

Total Dosage

1 hr                        2 hr                        3 hr

2 u                        4 u                        6 u
THE PIZZA BOLUS

*A 2005 STUDY INDICATES THAT THE BEST WAY TO KEEP BG’S IN TARGET RANGE AFTER PIZZA IS TO DELIVER THE INSULIN IN A 50/50 SPLIT SPREAD OUT OVER 8 HOURS!!!!!!!!!!

PERFECT WORLD

Bolus given at least 20 minutes before the meal

**Why:** after eating carbs blood sugar starts to rise within 5-10 minutes. Fast acting insulin starts to work to lower the blood sugar 15-20 minutes after it is given and only half of its glucose lowering action is seen 2 hrs later.

Post meal blood sugars are better controlled when boluses are given 20 minutes prior to the meal.
Bolus after meals:

- unsure of how much is going to be eaten
  - Young children, restaurant
- Habit

Solution:

- Give ½ of what you expect to be eaten before the meal, finish the bolus/injection after the meal is finished
- Give before
- If you are using a pump give the bolus for each course of the meal
Various tools for diabetes meal planning can be helpful and effective when used as part of daily diabetes care:

- Canada’s Food Guide
- Labels, Portions sizes, serving sizes
- Books and resources
- Bolus recommendations
- Advanced pump features
Carbohydrate Counting is a flexible system of meal planning that allows you to accurately determine insulin doses and help predict the impact of carbohydrate on your blood glucose results.

It is still important however to make health food choices as much as possible (DIABETES OR NOT!)
CARBOHYDRATE COUNTING IS A JOURNEY.....NOT A DESTINATION!

- YOU NEVER ACTUALLY GET THERE

- EDUCATED “GUESSTIMATES” ARE A REALITY

- BUT IT DOES IMPROVE CONSISTENCY IN INTAKE AND OVERALL GLYCEMIC CONTROL

- IT IS NOT WHAT YOU DO SOME OF THE TIME...BUT WHAT YOU DO MOST OF THE TIME THAT MAKES THE DIFFERENCE!!
RECOMMENDED CARB COUNTING RESOURCES

- 2009 Calorie King, Calorie, Fat and Carbohydrate Counter; Calorie King Wellness Solutions
- The Ultimate Guide to Accurate Carb Counting, Gary Scheiner, MS, CDE
- The Diabetes Carbohydrate and Fat Gram Guide; Lea Ann Holzmeister
Questions?
Comments?
Suggestions?
Thank you from the bottom of my pancreas...