

## Advanced Meal Planning Using Carbohydrate Counting

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## Carbohydrate Counting

- A meal planning approach where one is allowed a certain amount of carbohydrate (carb) choices or grams per meal and snack
- Facts:
  - Dietary carb has the most effect on postmeal BG levels
  - Gram for gram, carbs causes similar blood glucose excursions, despite the source.

## Carbohydrate & Blood Glucose

- All carbohydrate converts to glucose in as little as 10 minutes. 100% converts within 2 hrs
- **Fiber** does not increase blood glucose.
  - Large quantities of fiber (>5 grams per serving) may also slow digestion.
- **Dietary fat** may slow digestion and thus delay the rise in blood glucose
- **Protein** has been shown to have no effect on rise or fall of blood glucose levels

## Carb Counting

Benefits	Drawbacks
More flexibility	Time consuming/record keeping
No exchanges	Additional BG monitoring
Carb info available	Must be comfortable with label reading
	Doesn't address protein and fat (can lead to wt gain)

## Carbohydrate Types

- **Starches**
  - Breads/grains, pasta
- **Sugars**
  - Naturally occurring
  - Added sugars
- **Fiber**
  - Types



## Where do we get Carbohydrates?



Food Group	Carbs (g) per serving
Bread/Starch	15 grams
Fruit	15 grams
Milk	12 grams
Vegetables	5 grams
Meat	0 grams
Fat	0 grams

## What counts as a carb serving (~15 grams)?

### Bread/Starch

1 slice bread  
 ¾ c cold cereal  
 ½ c hot cereal  
 ½ c pasta  
 1/3 c rice  
 ½ c starchy vege

### Fruit

1 small fruit  
 ½ grapefruit  
 1 c fruit  
 ½ c juice

### Milk

1 c white milk  
 ½ c chocolate milk  
 6 oz light yogurt  
 4 oz regular yogurt



## What counts as a carb serving (~15 grams)?

### Other Carbohydrates

½ cup ice cream  
 ¼ cup sherbet  
 2" piece of unfrosted cake  
 2 small sandwich type cookies  
 1 oz (~12) potato chips  
 8 oz sports drink

4 oz regular pop  
 1 fun size candy bar  
 4 tsp table sugar  
 1 Tbsp Pancake syrup  
 1 Tbsp jam or jelly

## Portion Control

Most Americans under-estimate how much they really eat by 50% !

	<u>DM serv size</u>	<u>Usual serv size</u>
<b>Pasta (cooked)</b>	½ cup	1 cup
<b>Potato</b>	3 oz	7-8 oz
<b>Muffin</b>	1 oz	4 – 8 oz
<b>Popcorn</b>	3 cups	8 – 12 cups
<b>Juice</b>	4 oz	8 oz

## Handy Measures

- Fist = 1 cup, small fruit
- Handful = 1 oz snack food
- Thumb = 1 oz cheese
- Thumbtip = 1 tsp
- Woman's palm = 3 oz meat



## How many Carbs are needed ?

- Check with Registered Dietitian
- Dependent on age, height, weight, activity level, BG level



## Determining Amount of Carbs per meal

Population	Carb choices per meal
<b>Smaller, older, inactive women</b>	2-4
<b>Older, inactive women</b>	3-5
<b>Smaller, older, inactive men</b>	4-6
<b>Large, active women trying to lose weight</b>	
<b>Most older men</b>	
<b>Active women</b>	5-7
<b>Larger men desiring to lose weight</b>	
<b>Active, younger men</b>	6-8

## Factors that influence glycemic response to foods

- Amount of carb
- Type of carb (starches, sugar, fiber)
- Food processing
- Fat content
- Premeal BG
- Severity of glucose intolerance



## Label Reading

- Carb Terminology
  - No FDA approved definition for carb on label
- Nutrition Facts Label
  - Best to use **TOTAL CARBOHYDRATE**
  - 15 grams = 1 carb serving
  - Serving size helps determine total carb

## Total Carbohydrate

Total Carbohydrate 31g	10%
Dietary Fiber 0g	0%
Sugars 5g	
Protein 5g	

- Combination of:
  - **Dietary Fiber** (Soluble and Insoluble)
  - **Sugars** (naturally occurring and added)
  - **Sugar Alcohols**
  - **Other carbohydrate** (difference between total carbohydrate and sum total of dietary fiber, sugars, sugar alcohol if declared)

## Label Reading - Carbohydrate

Carb (g)	Carb Servings
0-5	Free
6-10	½
11-20	1
21-25	1 ½
26-35	2
36-39	2 ½
40-49	3
50-54	3 ½
55-64	4

## Total Fiber

- Sum of dietary and functional fiber
  - **Dietary Fiber:** nondigestible carbohydrate and lignin intrinsic and intact in plants
    - Help with constipation
    - Examples: cellulose, pectin, gums, fibers in oat and wheat bran, inulin, oligosaccharides, fructans, lignin
  - **Functional Fiber:** isolated, nondigestible carbohydrate that has beneficial physiological effects in humans
    - Delays gastric emptying → fullness and lower pp BG
    - Interfere with dietary fat and cholesterol absorption
    - Examples: resistant starch, pectin, guar gums, chitin, chitosan, inulin, dextrins, polydextrose, psyllium,

## Fiber

- Type of fiber makes a difference
  - Insoluble fiber: DOES NOT digest/absorb; provides minimal calories or carbs
  - Soluble fiber: is absorbed/digested; can contribute to carb amount.
- Supplies 1.5-2.5 calories per gram
- **If food has 5 or more gram of fiber/serving:** subtract half the fiber from the total carb
  - If *insoluble fiber* is listed separately, you can subtract all insoluble fiber from total carb

## How many carbs do you count?



### NUTRITION FACTS

Serving Size: 1 cup (50g/1.8oz)  
Servings Per Container: About 8

#### Amount/Serving

Calories 170  
Calories from Fat 15  
Total Fat 1.5g  
Saturated Fat 0g  
Trans Fat 0g  
Cholesterol 0mg  
Sodium 105mg  
**Carbohydrate 41g**  
**Dietary Fiber 8g**  
Soluble Fiber 1g  
Insoluble Fiber 7g  
Sugars 13g

## Sugars

- Includes naturally occurring and added sugars
- Best to look at total carbohydrate and use common sense
- Labeling
  - "No Added Sugars" and "Without Added Sugars" are allowed if no sugar or sugar containing ingredient is added during processing.
  - "Unsweetened" and "No Added Sweeteners" remain as factual statements
  - Does not include sugar alcohols

### Plain Yogurt

#### Nutrition Facts

Serving Size 1 container (226g)

Amount Per Serving	% Daily Value*
<b>Calories</b> 110	Calories from Fat 0
<b>Total Fat</b> 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	0%
Cholesterol Less than 5mg	1%
Sodium 160mg	7%
<b>Total Carbohydrate</b> 15g	5%
Dietary Fiber 0g	0%
Sugars 10g	
<b>Protein</b> 13g	
Vitamin A 0%	Vitamin C 4%
Calcium 45%	Iron 0%

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

INGREDIENTS: CULTURED PASTEURIZED GRADE A NONFAT MILK, WHEY PROTEIN CONCENTRATE, PECTIN, CARRAGEENAN.

### Fruit Yogurt

#### Nutrition Facts

Serving Size 1 container (227g)

Amount Per Serving	% Daily Value*
<b>Calories</b> 240	Calories from Fat 25
<b>Total Fat</b> 3g	4%
Saturated Fat 1.5g	9%
Trans Fat 0g	0%
Cholesterol 15mg	5%
Sodium 140mg	6%
<b>Total Carbohydrate</b> 46g	15%
Dietary Fiber Less than 1g	3%
Sugars 44g	
<b>Protein</b> 9g	
Vitamin A 2%	Vitamin C 4%
Calcium 35%	Iron 0%

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

INGREDIENTS: CULTURED GRADE A REDUCED FAT MILK, APPLES, HIGH FRUCTOSE CORN SYRUP, CINNAMON, NUTMEG, NATURAL FLAVORS, AND PECTIN; CROCODIUS ACTIVE YOGURT AND L. ACIDOPHILUS CULTURES.

## Which is has more carb?

A

B



### Nutrition Facts

Serving Size 1 Cup (32g/1.1 oz.)  
Servings Per Container About 17

Amount Per Serving	Cereal	Vitamins A&D	Fat Free Milk
<b>Calories</b>	120	160	
Calories from Fat	10	10	
% Daily Values**			
<b>Total Fat</b> 1g*	2%	2%	
Saturated Fat 0.5g	3%	3%	
Trans Fat 0g			
Cholesterol 0mg	0%	0%	
Sodium 150mg	6%	9%	
Potassium 35mg	1%	7%	
<b>Total Carbohydrate</b> 28g	9%	11%	
Dietary Fiber 1g	4%	4%	
Sugars 15g			
Other Carbohydrate 12g			
<b>Protein</b> 1g			

### Nutrition Facts

Serving Size 1 1/4 Cup (32g/1.1 oz.)  
Servings Per Container About 12

Amount Per Serving	Cereal	Vitamins A&D	Fat Free Milk
<b>Calories</b>	120	160	
Calories from Fat	10	10	
% Daily Values**			
<b>Total Fat</b> 1g*	2%	2%	
Saturated Fat 0.5g	3%	3%	
Trans Fat 0g			
Cholesterol 0mg	0%	0%	
Sodium 180mg	8%	11%	
Potassium 45mg	1%	7%	
<b>Total Carbohydrate</b> 28g	9%	11%	
Dietary Fiber 1g	4%	4%	
Sugars 10g			
Other Carbohydrate 17g			
<b>Protein</b> 2g			

## Comparison of Sweeteners

Sweetener	Cal per gram
Artificial (Aspartame, Saccharin, Splenda)	0
Sugar Alcohols:	
Erythritol	0.2
Mannitol	1.6
Isomalt	2.0
Lactitol	2.0
Maltitol	2.1
Xylitol	2.4
Sorbitol	2.6
Hydrogenated starch hydrolysates	3.0
Glycerine, sucrose, fructose, lactose	4.0

## Sugar Alcohols and Carb Counting

- Absorbed slowly and incompletely.
- Requires little or no insulin to be metabolized. Don't raise BG.
- Has ~ ½ - ¾ calories of regular sugar
- Can have laxative effect (bloating, gas, diarrhea) if consumed in large amounts.
  - Sorbitol and mannitol
  - Effect is dose dependent.

## Sugar Alcohols and Label Reading

- FDA Required Disclaimer
  - “Excess consumption may have a laxative effect” if consumers could ingest more than 50 g sorbitol or 20 g mannitol in one day.
- Label listing:
  - If product makes “sugar free” or “no sugar added” claim, must list sugar alcohol under Total Carbohydrate
  - If products contains more than one, it must use the term “Sugar alcohols” in labeling

## Sugar Alcohols and Carb Counting

- If all carb is from sugar alcohols
  - < 10 grams: FREE food
  - > 10 grams: count ½ of the total carb
- If all carb is from number of sources, including sugar alcohols
  - Subtract ½ of the sugar alcohol grams from the total carb

## How many carbs do you count?



### NUTRITION FACTS

Serving Size: 3 cookies (32g)  
Servings Per Container: About 5

#### Amount/Serving

Calories 170  
Calories from Fat 100  
Total Fat 11g  
Saturated Fat 2g  
Cholesterol less than 5mg  
Sodium 115mg  
**Carbohydrate 18g**  
**Dietary Fiber less than 1g**  
Sugars 0g  
**Maltitol 5g**

## How many carbs do you count?



### NUTRITION FACTS

Serving Size: 3 cookies (32g)  
Servings Per Container: About 5

#### Amount/Serving

Calories 130  
Calories from Fat 100  
Total Fat 6g  
Saturated Fat 2g  
Trans Fat 0g  
Cholesterol less than 0mg  
Sodium 135mg  
**Carbohydrate 23g**  
**Dietary Fiber 2g**  
Sugars 0g  
**Sugar alcohols 8g**

## How many carbs do you count?



### NUTRITION FACTS

Serving Size: 1 bar (31g)  
Servings Per Container: 1

#### Amount/Serving

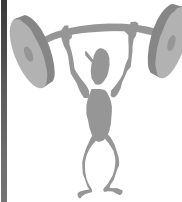
Calories 130  
Calories from Fat 100  
Total Fat 11g  
Saturated Fat 7g  
Trans Fat 0 g  
Cholesterol 10mg  
Sodium 15mg  
**Carbohydrate 18g**  
**Dietary Fiber 7g**  
Sugars less than 1g  
**Sugar alcohols 10g**  
**Protein 1 g**

### Which is better?



	Original	Whips	Light	Ultra	Custard
Serving size	<b>6 oz</b>	<b>4 oz</b>	<b>6 oz</b>	<b>6 oz</b>	<b>6 oz</b>
Calories	<b>170</b>	<b>140</b>	<b>100</b>	<b>90</b>	<b>190</b>
Fat (Sat fat)	1.5g (1)	2.5g (2)	0g	2.5g (1.5)	3.5g (2)
Carb (fiber)	<b>33g (0)</b>	<b>25g (0)</b>	<b>19g (0)</b>	<b>8g (0)</b>	<b>32g (0)</b>

### Advanced Carb Counting



- For those on insulin (MDI/Insulin Pump)
- Adjusts rapid-acting insulin based on carb consumed and physical activity
- Carb/Insulin Ratio
  - Direct relationship between insulin taken and food eaten.
  - Calculates insulin dose for a specific amount of carbohydrate

### Carb to Insulin Ratio's

- Starting point (if new to carb/insulin ratio's)
  - **1:15 ratio (take 1 unit fast acting insulin for every 15 g carb eaten)**
- May need different ratio's for different meals
- Example:
  - If eats 65 gm carb for lunch
  - Would need 4 units fast acting insulin coverage at lunch (65/15)

### 500 Rule for calculating carb:insulin

- Carb:insulin ratio =
  - $500/\text{total daily dose (TDD) of insulin}$
- **Example: TD's daily insulin regimen is:**
  - **40u Lantus qd and 8u Novolog** with meals TID
  - $\text{TDD} = 64$  (40 of Lantus + 24 of Novolog)
  - $500/64 = 7.8$
  - Carb:insulin ratio:
    - **1u Novolog for every 8 g carbohydrate**

### Checking Carb:Insulin Ratio's

1. Test pre-meal BG
  - If out of range: may need coverage
  - if within goal range: continue
2. Test 2 hr post-prandial BG
  - **Goal:**
    - **~140-180 mg/dl OR**
    - **50 mg/dl higher than pre-meal BG**
  - If 2 hr PPG is too low= more carb per/unit insulin
  - If 2 hr PPG is too high= less carb per/unit insulin

### Testing Carb:Insulin Ratio's

- Example:
  - Carb/Insulin Ratio= 1:15 (1 u humalog for 15 g carb)
  - Eats 60 g carb
  - How much humalog is needed/meal?  $\frac{4 \text{ units}}{(60/15)}$
- **BG Results:**
  - **Premeal BG:** 204, 133, 109, 112, 127
  - **2 hr PPG:** 158, 155, 139, 174, 146
- Questions:
  - Is PPG within desired parameters?
  - Would you adjust the ratio? increase/decrease?

### Testing Carb:Insulin Ratio's

- **RB's daily insulin regimen:**
  - 30u Lantus qd & 5u NovoLog each meal
  - What is the starting carb:insulin ratio?  
TDD:  $30 + 15 = 45$      $500/45 = 11$
- **BG results**
  - **Premeal BG:** 131, 122, 109, 133, 98
  - **2 hr PPG:** 95, 96, 100, 97, 63
- **Questions**
  - Is PPG within desired parameters?
  - Would you adjust?

### Testing Carb:Insulin Ratio's

- **Example:**
  - Carb/Insulin Ratio = 1:10
  - Eats 60 g carb (takes 6u Humalog)
- **BG Results:**
  - **Premeal BG:** 112, 109, 98, 143, 112
  - **2 hr PPG:** 101, 111, 90, 89, 120
  - **3 hr PP:** 77, 82, 64, 61, 95
- **Questions:**
  - Is PPG within desired parameters?
  - Do we adjust? Increase/decrease ratio?

### Testing Carb:Insulin Ratio's

- **LM's daily insulin regimen:**
  - 40u Lantus qd & 10u NovoLog each of 3 meals
  - What is the starting carb:insulin ratio?  
TDD:  $40 + 30 = 70$      $500/70 = 7.1$
- **BG results**
  - **Premeal BG:** 113, 130, 125, 100, 105
  - **2 hr PPG:** 203, 180, 200, 188, 209
  - **3 hr PP:** 167, 122, 134, 131, 95
- **Questions**
  - Is PPG within desired parameters?
  - Would you adjust?

### Testing Carb:Insulin Ratio's

- **JA's daily insulin regimen:**
  - 60u Lantus qd. Oral meds D/C'd 2 weeks ago
  - NovoLog with meals at a ratio of 1:15
- **BG results**
  - **Premeal BG:** 114, 126, 109, 133, 98
  - **3 hr PPG:** 185, 220, 190, 240, 223
- **Questions**
  - Is PPG within desired parameters?
  - Would you adjust?

### Reasons for BG fluctuations

1. Not checking BG correctly
2. Mixing insulin incorrectly
3. Incorrect dosing or administration time
4. Inconsistent carbohydrate in meal plan
5. Variance of site
6. Growth spurts/Weight changes
7. Stress/Illness
8. Changes in activity

### Nutrition and Gastroparesis

- **Nutritional Management:**
  - Consider regular insulin
  - Consider taking insulin after eating
  - Avoid high fat meals
  - Avoid high fiber meals
  - Eat small frequent meals

### Physical Activity Considerations (Insulin Using Clients)

- For planned activity:
  - Better to adjust insulin dose versus adding carbs, especially if trying to lose wt
- For unplanned activity or activities of long duration, supplemental carb is needed

### Physical Activity Considerations

- Pre-activity BG
  - **Crucial in determining carb amount**
  - BG > 180: OK for at least 30-60 min
  - BG < 100: will need carb replacement
  - Eating a snack 15-30 min before activity can prevent a low after activity
- Intensity and duration of activity planned

### Physical Activity: Adjusting Carb

Activity Level	Duration	Carb Needed
Mild/Moderate Intensity	< 30 min	BG > 100: none BG < 100: 10-15 g
Moderate Intensity	30-60 min	BG < 80: ~30 g before activity (then ~15 g per 30 min activity) BG 80-180: 10-15 g per 30 min activity BG > 180: none
High Intensity	> 60 min	BG < 80: ~45 g before activity (then ~15 g per 30 min activity) BG 80-180: 30-45 g per 30 min activity BG > 180: none

### Physical Activity Considerations

- Last meal time
- Medications:
  - peak time
  - where injected
- Hx of BG fluctuations with activity
- Risks of activity: dehydration, low BG

### Avoiding Hypoglycemia: Insulin users

- Regular BG monitoring: pre and **post**
  - *Effects of activity can last up to 24 hours*
- Avoid activity is BG <70 **or** < 100 and vigorous/long duration activity will occur
- Avoid injecting insulin in muscle used during exercise (*Best to use abdomen*)
- Carry extra carb: glucose tabs, gel

### In Review:

- Nutrition Goals
- Teaching Strategies



**Success with blood glucose control  
and lifestyle changes.**