

Making Carbs Count:

Advanced Carbohydrate Counting for Intensive Diabetes Management Case Study #1

Guy is a pleasant 30 year old male who has had type 1 diabetes for 20 years. Last year he came to see you to learn about basic carbohydrate counting. He has been carbohydrate counting and trying to follow a consistent carbohydrate meal plan since that time. Guy is coming to learn advanced carbohydrate counting skills because he wants to improve his glycemic control and have a more flexible lifestyle.

Ht: 6' (183 cm)

Wt: 183 lbs. (83 kg)

BMI = 24.8

Guy's insulin: 12 u intermediate-acting insulin bid
8 u rapid-acting insulin with meals

Total daily dose (TDD) = 48 u/day

Guy's target blood glucose levels: ac meals 4-7 mmol/L

2 hr pc meals 5-10 mmol/L

Guy's latest HbA1C = 7.9

Guy brings detailed food records to his appointment.



Questions/Problems

- 1) Examine Guy's initial food records of August 19, 20 and 21. What are the first steps that should be taken in teaching Guy advanced carbohydrate counting?

(5 min)

Calculating insulin:carb ratios

- 2) Calculate Guy's insulin:carb ratio using all 3 methods.

(6 min)

- a) **Method 1:** Pattern Management for any meals that are applicable (i.e. when # units of insulin taken seem to give appropriate control for grams of carbohydrate eaten)

- b) **Method 2:** $500 \div \text{TDD}$

- c) **Method 3:** $\text{TDD} - \text{basal insulin requirement} = \text{bolus requirement}$
 $\text{Average CHO eaten/day} \div \text{bolus requirement} = \text{insulin:carb}$

Case Study #2: Determining insulin to carb ratio using Pattern Management and carb choices

Samantha is Guy’s supervisor at work (weight 260 lbs/118 kg; “math reluctant”). She has type 2 diabetes, is on an insulin pump and prefers to work in carbohydrate choices. (1 carb choice = 15 g carbohydrate)

3) Examine Samantha’s food record. Calculate her insulin:carb choice ratio at all meals. (2 min)

Calculating Insulin Sensitivity Factors (ISF)

100 ÷ TDD for R/A (rapid-acting) insulin **OR**
 85 ÷ TDD for R(Regular) insulin or insulin-resistant individuals

4) Calculate Guy’s ISF from his food records. (1 min)

Using ISF to calculate a supplemental dose

(Current BG – goal BG) ÷ ISF = supplemental dose

5) Guy’s BG before lunch is 10.2 mmol/L but his pre-meal target is 6 mmol/L. If his ISF is 2, what is his supplemental dose at lunch? (1 min)

Applying the Principles

6) Using the following information and the food lists provided, calculate Guy’s lunch time insulin dose. (5 min)
 Pre-meal target BG = 6 mmol/L insulin:carb ratio = 10 ISF = 2

Meal	Food Eaten	# grams of carbs	Insulin Taken
Lunch Time: 12:30 Blood Glucose: 11.2	Ham & cheese sandwich 200 mL juice box (orange) 125 mL strawberry yogurt medium apple 50 g bag chips	_____	Meal Bolus: _____ Correction: _____ Total Taken: _____

7) Examine Guy’s follow-up food record. Assess it for how well Guy has applied the information he has been taught. What changes can you find? (2 min)

Advanced Carbohydrate Counting Daily Worksheet: Grams of Carb

DATE Thursday August 19, 2004

For: Guy (Initial)

Meal	Food Eaten (include portion)	# grams of carbs	Insulin Taken
Basal Insulin:			12 NPH
Breakfast Time: 7:00 am Blood Glucose: 6.3	2 toast^a + 1 tsp margarine 2 slices cheddar cheese coffee with 1 tsp sugar 1 cup 1% milk 1 medium orange^a	32 10 5 12 <u>15</u> 72	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two hour BG: 7.8			
Activity: *	At work (sitting)		
Snack Time: 10:00 am Blood Glucose:	Coffee with 1 packet sweetener and 1 milker	0 _____	Meal Bolus: <u>0</u> Correction: <u>0</u> Total Taken: 0
Lunch Time: 12:45 pm Blood Glucose: 6.9	Tuna sandwich on ww bread^a Tossed salad with oil & vinegar 50 g bag chips^a 1 medium apple^a diet pop	32 0 31 20 <u>0</u> 83	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two Hour BG: 7.2			
Activity:	At work (sitting)		
Snack Time: 2:45 pm Blood Glucose: 7.2	Diet pop	0 _____	Meal Bolus: <u>0</u> Correction: _____ Total Taken: 0
Supper Time: 6:30 pm Blood Glucose: 6.9	Hamburger on bun with mustard Tossed salad w. Italian dressing +1/2 c. croutons^a Small cob of corn^a 1/2 c fruit salad^a + whipped cream	30 11 30 <u>10</u> 81	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two hour BG: 3.8	ate chocolate bar to treat low		
Activity:	Bowling for 1 hour (7 -8 pm)		
Snack Time: 10:30 pm Blood Glucose: 9.8	1 cup milk 1 toast^a with peanut butter	12 <u>16</u> 28	Meal Bolus: <u>0</u> Correction: <u>0</u> Total Taken: 0
Basal Insulin:			12 NPH
Bedtime Glucose: 9.8 Time: 10:30 pm			
Comments:			

* Write in activity or use 1: less than normal activity, 2: normal activity, 3: more than normal activity.

^a Nutritional information from resource

My Insulin Sensitivity is: 1 unit drops blood glucose _____ mmol/l.

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (breakfast)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (lunch)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (supper)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (bedtime snack)

Advanced Carbohydrate Counting Daily Worksheet: Grams of Carb

DATE Friday August 20, 2004

For: Guy (Initial)

Meal	Food Eaten (include portion)	# grams of carbs	Insulin Taken
Basal Insulin:			12 NPH
Breakfast Time: 7:00 am Blood Glucose: 9.3	2 toast^a 1 tbsp peanut butter coffee with 1 tsp sugar 1 cup 1% milk 1/2 medium grapefruit^a	32 0 5 12 <u>20</u> 67	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two hour BG: 6.4			
Activity: *	3 (moved boxes and furniture in office)		
Snack Time: 10:00 am Blood Glucose: 4.2	Coffee with 1 packet sweetener and 1 milker	0 _____	Meal Bolus: <u>0</u> Correction: <u>0</u> Total Taken: 0
Lunch Time: 12:45 pm Blood Glucose: 3.5	Ham and cheese sandwich on ww bread^a 3 c.c. cookies^a 1 medium apple^a diet pop	32 30 20 <u>0</u> 82	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two Hour BG: 5.1			
Activity:	At work (sitting)		
Snack Time: 2:45 pm Blood Glucose: 5.1	Diet pop	0 _____	Meal Bolus: <u>0</u> Correction: _____ Total Taken: 0
Supper Time: 6:30 pm Blood Glucose: 3.2	Steak 1 cups rice pilaf (long-grain brown) ^a Caesar salad (no croutons) 1 cup orange and mango juice^a 3 cc cookies (ate extra for low BG)	0 45 0 30 <u>30</u> 105	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two hour BG: 12.1			
Activity:			
Snack Time: 10:30 pm Blood Glucose: 10.5	1 cup milk 1 toast^a with peanut butter	12 <u>16</u> 28	Meal Bolus: <u>0</u> Correction: <u>0</u> Total Taken: 0
Basal Insulin:			12 NPH
Bedtime Glucose: 10.0 Time: midnight			
Comments:			

* Write in activity or use 1: less than normal activity, 2: normal activity, 3: more than normal activity.

^a Nutritional information from resource

My Insulin Sensitivity is: 1 unit drops blood glucose _____ mmol/l.

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (breakfast)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (lunch)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (supper)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (bedtime snack)

Advanced Carbohydrate Counting Daily Worksheet: Grams of Carb

DATE Saturday August 21, 2004For: Guy (Initial)

Meal	Food Eaten (include portion)	# grams carbs	Insulin Taken
Basal Insulin:			12 NPH
Breakfast Time: 8:00 am Blood Glucose: 6.3	1 english muffin 1 tbsp peanut butter 2 tsp diet jam coffee with 1 tsp sugar 1 cup 1% milk 1/2 medium grapefruit^a	30 0 4 5 12 <u>20</u> 71	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two hour BG: 6.4			
Activity:	Grocery shopping for 1 hour		
Snack Time: 10:00 am Blood Glucose: 6.4	200 ml juice box (orange)^a	20 _____	Meal Bolus: <u>0</u> Correction: <u>0</u> Total Taken: 0
Lunch Time: 12:45 pm Blood Glucose: 4.6	Hamburger with mustard Small French fries^a 50 g chocolate bar^a diet pop	30 30 26 <u>0</u> 86	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two Hour BG:			
Activity:	Watching TV (Olympics)		
Snack Time: Blood Glucose:	Diet pop while watching TV. Forgot to test 2 hours after lunch. Nibbled on a few snack items.	0 _____	Meal Bolus: <u>0</u> Correction: _____ Total Taken: 0
Supper Time: 6:30 pm Blood Glucose: 10.8	BBQ chicken breast Medium baked potato^a ½ c green beans 1 large cob of corn^a 1 c raspberries^a	0 30 0 30 <u>10</u> 70	Meal Bolus: <u>8</u> Correction: <u>0</u> Total Taken: 8 rapid
Two hour BG: 9.5			
Activity:			
Snack Time: 10:30 pm Blood Glucose: 8.5	1 cup milk 1 toast^a with peanut butter	12 <u>16</u> 28	Meal Bolus: <u>0</u> Correction: <u>0</u> Total Taken: 0
Basal Insulin: 10:30			12 NPH
Bedtime Glucose: 9.9 Time: midnight			
Comments:			

* Write in activity or use 1: less than normal activity, 2: normal activity, 3: more than normal activity.

^a Nutritional information from resource

My Insulin Sensitivity is: 1 unit drops blood glucose _____ mmol/l.

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (breakfast)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (lunch)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (supper)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carbohydrates (bedtime snack)

Advanced Carbohydrate Counting Daily Worksheet: Carb Choices

DATE Friday August 20

For: *Samantha*

Meal	Food Eaten (include portion)	# carb choices	Insulin Taken
Basal Insulin:			
Breakfast Time: <i>7:30</i> Blood Glucose: <i>5.9</i>	<i>1 English muffin with peanut butter</i> <i>1 medium orange</i> <i>tea with s/a skim milk</i> <i>125 g fruit yogurt</i>	<i>2</i> <i>1</i> <i>0</i> <u><i>1</i></u> <i>4</i>	Meal Bolus: <u><i>16.4</i></u> Correction: <u><i>0</i></u> Total Taken: <i>16.4</i>
Two hour BG: <i>7.4</i>			
Activity: *	<i>Walked to work (1/2 hour)</i>		
Snack Time: <i>10:30</i> Blood Glucose:	<i>Tea with 1 milker</i>	<i>0</i> <u> </u> <i>0</i>	Meal Bolus: <u><i>0</i></u> Correction: <u> </u> Total Taken: <i>0</i>
Lunch Time: <i>12:15</i> Blood Glucose: <i>6.1</i>	<i>Hamburger</i> <i>Chicken noodle soup (1 cup)</i> <i>Celery sticks and cucumber slices</i> <i>1 small apple</i> <i>1 c. skim milk</i>	<i>2</i> <i>1</i> <i>0</i> <i>1</i> <u><i>1</i></u> <i>5</i>	Meal Bolus: <u><i>15.5</i></u> Correction: <u><i>0</i></u> Total Taken: <i>15.5</i>
Two Hour BG: <i>7.1</i>			
Activity:			
Snack Time: <i>3:30</i> Blood Glucose: <i>6.1</i>	<i>2 sugar-free cookies</i> <i>plain tea</i>	<i>0</i> <u> </u> <i>0</i>	Meal Bolus: <u><i>0</i></u> Correction: <u> </u> Total Taken: <i>0</i>
Supper Time: <i>6:30 pm</i> Blood Glucose: <i>10.6</i>	<i>1 pork chop w. 1/2 c applesauce</i> <i>1 medium baked potato w. yogurt</i> <i>tossed salad w. light dressing</i> <i>diet soda</i> <i>1/2 c frozen yogurt</i>	<i>1</i> <i>2</i> <i>0</i> <i>0</i> <u><i>1</i></u> <i>4</i>	Meal Bolus: <u><i>14.4</i></u> Correction: <u><i>4.4</i></u> Total Taken: <i>18.8</i>
Two hour BG: <i>8.1</i>			
Activity:	<i>Walked home from work (1/2 hour)</i>		
Snack Time: <i>10:15</i> Blood Glucose: <i>6.5</i>	<i>1 cup skim milk</i> <i>1 slice ww toast with peanut butter</i>	<i>1</i> <u><i>1</i></u> <i>2</i>	Meal Bolus: <u><i>2</i></u> Correction: <u> </u> Total Taken:
Basal Insulin:			
Bedtime Glucose: <i>7.3</i> Time: <i>midnight</i>			
Comments:			<i>51 units/d basal</i>

* Write in activity or use 1: less than normal activity, 2: normal activity, 3: more than normal activity.

My Insulin Sensitivity is: 1 unit drops blood glucose _____ mmol/l.

My Insulin:Carbohydrate ratio is: _____ unit for 1 carbohydrate choice (breakfast)

My Insulin:Carbohydrate ratio is: _____ unit for 1 carbohydrate choice (lunch)

My Insulin:Carbohydrate ratio is: _____ unit for 1 carbohydrate choice (supper)

My Insulin:Carbohydrate ratio is: _____ unit for 1 carbohydrate choice (bedtime snack)

Advanced Carbohydrate Counting Daily Worksheet: Grams of Carb

DATE Saturday August 28, 2004

For: Guy (Follow up)

Meal	Food Eaten (include portion)	# grams of carbs	Insulin Taken
Basal Insulin:			12 NPH
Breakfast Time: 8:30 am Blood Glucose: 6.9	<i>2 waffles (frozen) ^a</i> <i>1 tsp margarine</i> <i>2 tsp maple syrup ^a</i> <i>coffee with 1 tsp sugar</i> <i>1 cup 1% milk</i> <i>1 cup orange and mango juice ^a</i>	30 0 9 5 12 <hr/> 30 86	Meal Bolus: <u> 11 </u> Correction: <u> 0 </u> Total Taken: 11 rapid
Two hour BG: 7.7			
Activity: *	Shopping (10:15)		
Snack Time: 10:30 am Blood Glucose: 7.7	<i>200 ml juice box (orange) ^a</i>	20 <hr/> 20	Meal Bolus: <u> 0 </u> Correction: <u> 0 </u> Total Taken: 0
Lunch Time: 1:30 pm Blood Glucose: 5.9	<i>club sandwich on ww ^a bread</i> <i>1 cup bean salad ^a</i> <i>1 cup fruit salad ^a</i> <i>diet pop</i>	48 30 20 <hr/> 0 98	Meal Bolus: <u> 10 </u> Correction: <u> 0 </u> Total Taken: 10 rapid
Two Hour BG: 7.5			
Activity:	Watching football on TV		
Snack Time: Blood Glucose:	<i>Diet pop</i>	0 <hr/>	Meal Bolus: <u> </u> Correction: <u> </u> Total Taken:
Supper Time: 7:00 pm Blood Glucose: 9.8	<i>2 cups spaghetti ^a + $\frac{3}{4}$ cup meat sauce ^a</i> <i>1 slice garlic bread</i> <i>Tossed salad w. Italian dressing</i> <i>1 glass red wine</i> <i>$\frac{1}{2}$ c fruit salad ^a + whipped cream</i>	80 + 15 15 0 0 <hr/> 10 120	Meal Bolus: <u> 10 </u> Correction: <u> 2 </u> Total Taken: 12 rapid
Two hour BG: 8.1			
Activity:	Went to the movies		
Snack Time: 9:00 pm Blood Glucose: 8.1	<i>Diet pop</i> <i>9 cups popcorn ^a (estimated medium size)</i>	<hr/> 51 51	Meal Bolus: <u> 2 </u> Correction: <u> 0 </u> Total Taken: 2 rapid
Basal Insulin:			12 NPH
Bedtime Glucose: 7.5 Time: 11:30 pm			
Comments:	(note: usual bedtime snack = 28 g carbs with no RA insulin if BG <7.0)		

* Write in activity or use 1: less than normal activity, 2: normal activity, 3: more than normal activity.

^a Nutritional information from resource

My Insulin Sensitivity is: 1 unit drops blood glucose 2 mmol/l.

My Insulin:Carbohydrate ratio is: 1 unit for 8 grams of carbohydrates (breakfast)



My Insulin:Carbohydrate ratio is: 1 unit for 10 grams of carbohydrates (lunch)

My Insulin:Carbohydrate ratio is: 1 unit for 11 grams of carbohydrates (supper)

My Insulin:Carbohydrate ratio is: 1 unit for 15 grams of carbohydrates (bedtime snack)

Carbohydrate Resource Sheet: Making Carbs Count Workshop

Guy used different resources in addition to food labels and the basic information that he learned using the **Good Health Eating Guide Resource** to look up carbohydrate values for the items he consumed over the week.

Resource	Item	Portion Listed	Grams Carb
 <p>Nutrient Value of Some Common Foods www.publications.gc.ca</p>	Apple	7 in diameter	21g – 2.6 g fibre = 18.4 g
	Orange	1 medium	15 – 2.4 g fibre = 12.6 g
	Grapefruit	½ medium	9.2 – 1.2 g fibre = 8 g
	Raspberries, raw	125 mL	8 – 3.2 g fibre = 4.8 g
	Corn	20 cm cob	30 – 4.5 g fibre = 25.5 g
	Croutons	125 mL	12 – 0.8 g fibre = 11.2 g
	Popcorn	250 ml	7 – 1.3 g fibre = 5.7 g
	Potato, baked, flesh only	12 cm long	34 – 3.4 g fibre = 31.6 g
	Rice, long grain brown, cooked	250 mL	48 – 3.1 g fibre = 44.9 g
	Spaghetti, cooked	250 mL	42 – 2.4 g fibre = 39.6 g
	Syrup, maple	10 mL	9 g
 <p>Carbs, Carbs and More</p>	Chocolate bar (from package)	50 g bar	26 g
	Chips, potato (from package)	50 g bag	31 g
	Cookies, Chocolate chip (from package)	2	19.8 g
	French Fries (favourite fast food restaurant)	Small	30 g
	Fruit salad, fresh	1 cup	20 g
	Juice, orange	200 ml	20 g
	Salad, bean	1/2 cup	19 g – 4 g fibre = 15 g
	Sauce, tomato with meat	½ cup	9.8 g
	Waffles, frozen (from package)	2	32 – 1.7 g fibre = 30.3 g
	yogurt, strawberry, low-fat	125 g	19.7 g

Carbohydrate Resource Sheet: Making Carbs Count Workshop

Granny's Whole Wheat Bread			
Nutrition Facts			
Valeur nutritive			
Per 66 g = 2 slices / par 66 g 2 tranches			
Amount	% Daily Value		
Teneur	% valeur quotidienne		
Energy/Énergie	192 Cal/800 kJ		
Fat/Lipides	4 g		
Saturated/saturés	3 g		
+ Trans/trans	1 g		20%
Cholesterol / Cholesterol	0 mg		
Sodium/Sodium	384 mg		15%
Carbohydrate/Glucides	36 g		9%
Fibre/Fibres	4.1 g		16%
Sugars/Sucres	1.3 g		
Protein/Protéines	6.8 g		
Vit A	0%	Vit C	0%
Calcium	0.5 %	Iron/Fer	18%

Paradise Orange and Mango Juice			
Nutrition Facts			
Valeur nutritive			
Per 175 mL serving / par portion de 175 mL			
Amount	% Daily Value		
Teneur	% valeur quotidienne		
Energy/Énergie	87 Cal / 360 kJ		
Protein/Protéines	0.7 g		
Fat/Lipides	0 g		
Carbohydrate/Glucides	21 g		5%
Sugars/Sucres	21 g		
Vit C	30%		

Advanced Carbohydrate Counting Daily Worksheet: Grams of Carb

DATE: _____

FOR: _____

Meal	Food Eaten (include portion)	# grams carb	Insulin Taken
Basal Insulin:			
Breakfast Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Two hour BG:			
Activity:			
Snack Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Lunch Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Two Hour BG:			
Activity:			
Snack Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Supper Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Two hour BG:			
Activity:			
Snack Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Basal Insulin:			
Bedtime Glucose: Time:			
Comments:			

* Write in activity or use 1: less than normal activity, 2: normal activity, 3: more than normal activity.

My Insulin Sensitivity is: 1 unit drops blood glucose _____ mmol/l.

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carb (breakfast)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carb (lunch)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carb (supper)

My Insulin:Carbohydrate ratio is: _____ unit for _____ grams of carb (bedtime snack)

Advanced Carbohydrate Counting Daily Worksheet: Carb Choices

DATE: _____

FOR: _____

Meal	Food Eaten (include portion)	# carb choices	Insulin Taken
Basal Insulin:			
Breakfast Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Two hour BG:			
Activity:			
Snack Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Lunch Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Two Hour BG:			
Activity:			
Snack Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Dinner Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Two hour BG:			
Activity:			
Snack Time: Blood Glucose:			Meal Bolus: ____ Correction: ____ Total Taken: ____
Basal Insulin:			
Bedtime Glucose: Time:			
Comments:			

* Write in activity or use 1: less than normal activity, 2: normal activity, 3: more than normal activity.

My Insulin Sensitivity is: 1 unit drops blood glucose _____ mmol/l.

My Insulin:Carbohydrate ratio is: _____ unit for 1 carb choice (breakfast)

My Insulin:Carbohydrate ratio is: _____ unit for 1 carb choice (lunch)

My Insulin:Carbohydrate ratio is: _____ unit for 1 carb choice (supper)

My Insulin:Carbohydrate ratio is: _____ unit for 1 carb choice (bedtime snack)