11.1 Calculate Your Insulin Pump Carb Factor

To find a starting CarbF, multiply your weight(lb) by 2.4 grams per pound and divide this number by your 14-day average betterTDD or current average TDD in a calculator:

$$\text{Pump CarbF} = \left(\frac{2.4 \times \text{Wt(lb)}}{\text{betterTDD}}\right) \text{ or } \left(\frac{5.3 \times \text{Wt(kg)}}{\text{betterTDD}}\right) \quad \text{AID CarbF} = \left(\frac{2.23 \times \text{Wt(lb)}}{\text{betterTDD}}\right) \text{ or } \left(\frac{4.9 \times \text{Wt(kg)}}{\text{betterTDD}}\right)$$

For example, if a person's weight is 160 lbs and their 14 day average betterTDD is 45 units a day, their CarbF would be 2.4 g/lb x 160 lbs / 45 u = 8.5 grams of carb per unit. From experience, if 8 units covers 70 grams of breakfast carbs, your CarbF for breakfast will be 70 g / 8.0 units or 8.8 grams per unit.

11.2 How High Should Your Glucose Go After a Meal?

The American Diabetes Assoc. recommended in 2001 that post-meal readings not go above 180 mg/dL (10 mmol/L) at two hours.[113] The European Diabetes Policy Group recommended post-meal readings go no higher than 165 mg/dL (8.9 mmol/L) in Type 2 diabetes to prevent diabetes complications, and no higher than 135 mg/dL (7.5 mmol/L) to prevent heart attacks and strokes in those at risk.[114] In 2011, the Inter. Diabetes Federation recommended that postprandial glucose levels stay below 160 mg/dL (9.0 mmol/L) 1 to 2 hours after meals for both Type 1 and 2 as long as hypoglycemia is avoided.[115] Post-meal targets in pregnancy are even tighter with a goal of staying below 130 mg/dL (7.2 mmol/L) after meals.[116]

11.3 Math for Carb Boluses

Grams of Carb/CarbF = Carb Bolus

So, for 44 grams of carb and a CarbF of 11 grams/u:

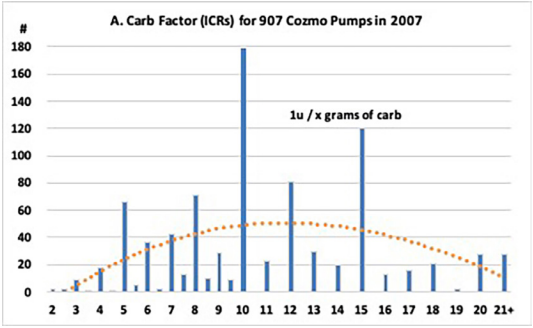
44 grams/(11 grams/u) = 4.0 u for a carb bolus

11.4 What to Ask When You Bolus

- What is my glucose?
- What is the direction of my trend line?
- What is my IOB?
- What should I do?

11.5 CarbFs – Often Inaccurate

This graphic shows the CarbFs found in 907 pumps turned in for a software upgrade.86 20% of these pumpsused 10 grams for their CarbF, while only 4% used 9 grams and 2.5% used 11 grams. Only 41% of the CarbFs matched an expected distribution, shown by the curved line in the figure.



People & health-care professionals prefer easy-to-use CarbFs like 5, 10, 15, and 20, rather than accurate ones. A difference of 1 gram or less in the CarbF dramatically changes glucose readings after multiple daily meals and snacks.

Always start CarbF checking with a CarbF from Table 9.7 or using Box 11.1.

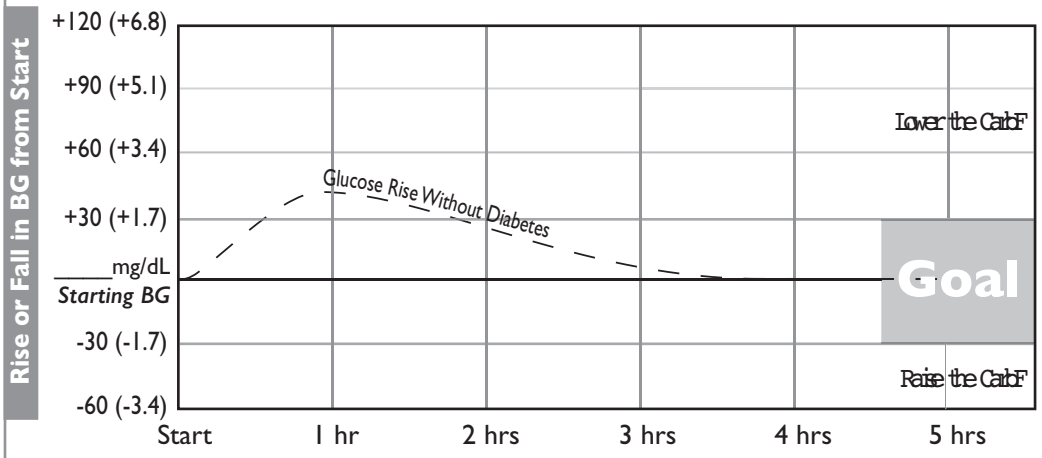
11.6 Real-time CarbF Test

The 24-hr window on the right shows mildly elevated glucose spikes in the post meal-readings. The CarbF appears OK since readings come down in about 4 hours. Giving carb boluses earlier before meals or adding low GI foods would reduce the post-meal rises.

11.7 Assess Your Carb Factor

Date: ____ /____/_____ **CarbF: 1u /** ____ **gram** **Carbs:** ____ **gr** **Bolus:** ____ **u**

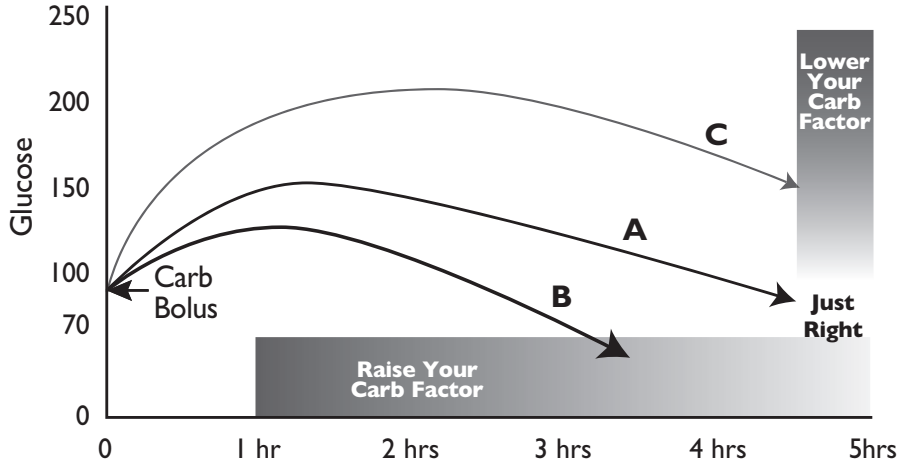
	Start	**~ 1 hr later**	**~ 2hrs later**	**~ 3 hrs later**	**~ 4 hrs later**	**~ 5 hrs later**
	_____ am/pm	_____ am/pm	_____ am/pm	_____ am/pm	_____ am/pm	_____ am/pm
BG:	_____ mg/dl	_____ mg/dl	_____ mg/dl	_____ mg/dl	_____ mg/dl	_____ mg/dl
Change in BG =	_____ mg/dl	_____ mg/dl	_____ mg/dl	_____ mg/dl	_____ mg/dl	_____ mg/dl



Goal: Test and adjust your CarbF until it brings your glucose within 20 mg/dL (1.1 mmol/L) of your start 5 hours later. Wait at least 5 hours after your last bolus and 3 hours after last carbs.

1. Start checking your glucose when it is between 90 to 140 mg/dL (5.0 to 7.8 mmol/L).
2. Eat enough carbs to challenge your CarbF, such as grams equal to half your weight in lbs (or equal to your weight in kgs). For example, if you weigh 140 lbs, have 70 grams of carbs. Select foods low in fat and protein.
3. Enter the carb count into your pump without a glucose reading and deliver the recommended carb bolus 20 minutes before you eat.
4. Check your glucose each hour with your CGM or test with a meter for the next 5 hours. Stop and eat carbs if your glucose goes below 70 mg/dL (3.9 mmol/L).
5. Plot readings from the 6 hour real-time screen on your CGM (or meter) on the graph.

11.8 How to Adjust Your Carb Factor



Adjust your CarbF from the Glucose Path:

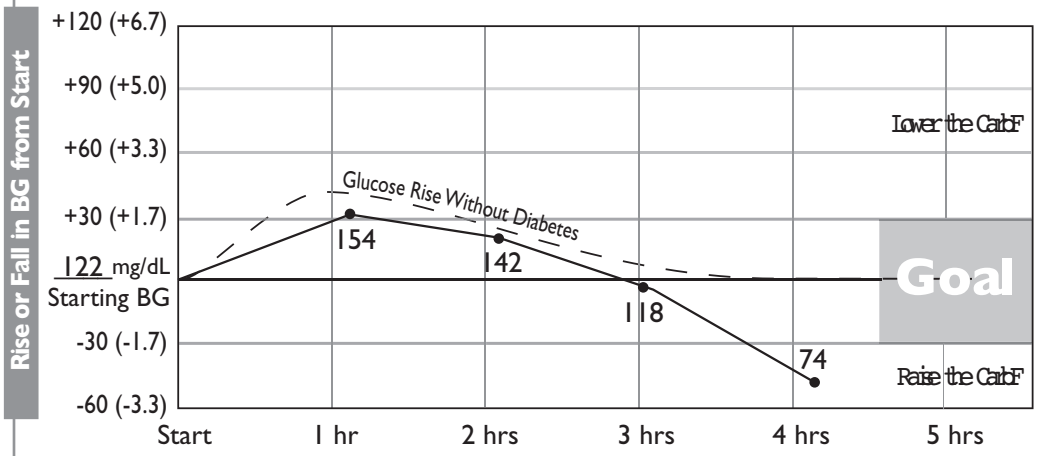
1. The CarbF is appropriate (Arrow A) when your glucose ends up within 20 mg/dL (1.1 mmol/L) above or below your starting glucose after 5 hours. Recheck to verify.
2. If your glucose goes low (B), increase your CarbF number to get smaller carb boluses.
3. If your glucose typically stays more than 20 mg/dL (1.1 mmol/L) above your starting glucose at 5 hours (C), decrease your CarbF to get larger boluses.
4. Use this table to see how much to change your CarbF:

If current CarbF is:	Adjust up or down by:
Less than 5.0 grams per unit	0.2 to 0.3 grams per unit
5-10 grams per unit	0.3 to 0.5 grams per unit
10-15 grams per unit	1 gram per unit
16-24 grams per unit	1 to 2 grams per unit
Larger or smaller CarbF changes may be needed.	

11.9 Elaine Checks and Adjusts Her Carb Factor

Date: 9 / 22 / 17 **CarbF: 1u /** 10 **gram Carbs:** 80 **gr Bolus:** 8.0 **u**

	Start	~ 1 hr later	~ 2hrs later	~ 3 hrs later	~ 4 hrs later	~ 5 hrs later
Time:	12:00 am/(pm)	1:10 am/(pm)	2:05 am/(pm)	3:00 am/(pm)	4:07 am/(pm)	_____ am/pm
BG:	122 mg/dl	154 mg/dl	142 mg/dl	118 mg/dl	74 mg/dl	_____ mg/dl
Change in BG:	+32 mg/dl	+20 mg/dl	-4 mg/dl	-48 mg/dl	_____ mg/dl	



On a new diet, Elaine began to have mild lows in the late afternoon. Basal testing showed her basal rates kept her glucose flat when she was not eating. At noon, 5 hours after her breakfast bolus, she decided to confirm her CarbF by having lunch at a local Italian diner. She took the 7 units her pump recommended for 70 grams of linguine (CarbF = 1u/10 grams).

Her glucose started at 122 mg/dL (6.1 mmol/L), rose to 154 mg/dL an hour later, then fell to 76 mg/dL (4.2 mmol/L) only 4 hours later, 48 mg/dL below her start. Elaine emailed her test results to her clinician who suggested she raise her CarbF from 1u/10 grams to 1u/11 grams. This reduction in her lunch boluses eliminated many of her afternoon lows.

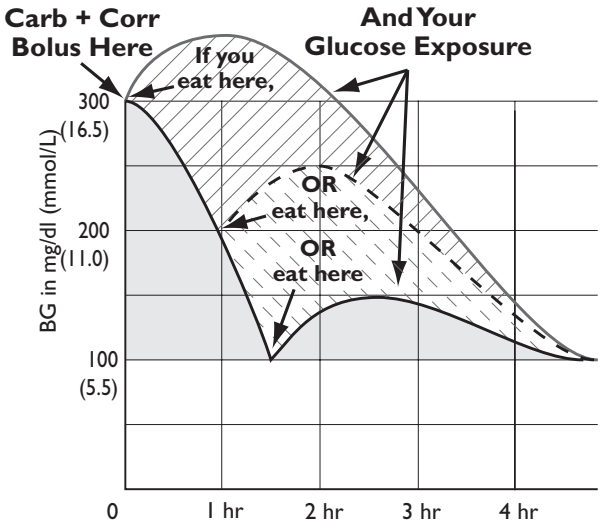
11.10 A Quick Way to Verify Carb Counts

To approximate your daily calorie intake, multiply the 14-day average carb count in your pump history by 10. For example, if your pump shows 80 grams of carb per day, this is equivalent to approximately 800 total calories a day. If you weigh less than 70 lbs. (32 kgs.), this calorie intake may be appropriate. But if you're an adult, you may be on a low carb diet, missing meal boluses, or under-counting carbs.

If your average carb count seems low or post-meal readings vary a lot, a visit to your dietitian is a quick way to reduce this. Bring along a three-day food diary of the foods, snacks, and caloric beverages you eat at each meal and your estimated carb count for your dietitian to review with you.

11.11 Reduce Glucose Exposure by Waiting to Eat When Above Target Range

If a glucose is above 140 mg/dL (7.8 mmol/L) before a meal, reduce glucose exposure by waiting to eat, as shown in the figure on the left. The higher your glucose, the longer you might delay eating after you bolus. Enter your glucose and carb grams and take the recommended bolus. When able, wait to eat until your glucose is below 140 mg/dL. Don't delay too long and don't try this if you might forget to eat or you have hypo unawareness. Set an alarm for the times in the table. Please be careful.

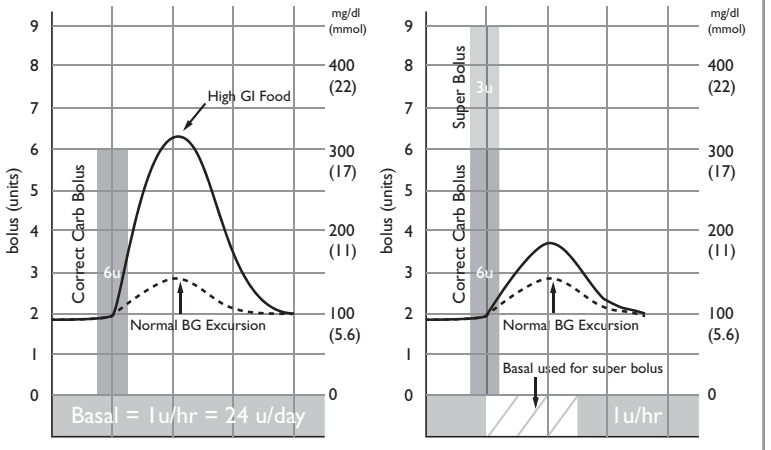


How Long to Wait before You Eat

A high glucose rarely falls faster than 3 mg/dL (0.17 mmol/L) a minute. The estimates below give reasonably safe times to wait to eat after giving a carb plus correction bolus. Watch your CGM!

Pre-meal BG	Approx. Wait Time
90-120 mg/dL	10-20 min
150 mg/dL	30 min
180 mg/dL	40 min
210 mg/dL	50 min
240 mg/dL	60 min
270 mg/dL	70 min
300 mg/dL	80 min

11.12 How a Super Bolus Works



Instead of taking 6 units for breakfast cereal, start a temp basal rate at 20% (80% reduction) of the 1.0 u/hr basal rate over the next 3 hours. The 2.4 units from this basal reduction (1.0 u/hr x 0.8 x 3 hrs = 2.4 units) can be added to the 6.0 u meal bolus. This covers the cereal with a larger 8.4 u bolus (6.0 u + 2.4 u) with little risk of going low later.