bcdiabetes.ca
Patient Care + Research + Clinical Trials

Dr. Tom Elliott MBBS, FRCPC
Medical Director

400 - 210 W Broadway
Vancouver, BC
V5Y 3W2 Canada

phone: 604.683.3734
fax: 604.628.3821
email: info@bcdiabetes.ca

Carb Counting

Carbohydrate ("carb") counting is the process of making an intelligent guess as to how much starch or carbohydrate is contained in the meal you are about to eat. Carbs are usually estimated in units of grams (1 oz = 28 grams). The reason for counting carbs is that the ideal dose of meal time rapid (ultra-short-acting) insulin is directly proportional to the carbs you are about to eat.

First you have to learn the carb values for common starchy foods – these can be obtained from a number of resources. A good place to start is www.bcchildrens.ca/Services/SpecializedPediatrics/EndocrinologyDiabetesUnit/ForFamilies/DiabetesHandouts.htm#nutrition [link].

The next thing you need to figure out is how many grams of carbs it takes to neutralize the effect of one unit of rapid insulin. This value is often called the "carb ratio". People with Type 1 diabetes who are very sensitive to insulin may require as many as 20 grams of starch to neutralize one unit of rapid insulin (ie their "carb ratio" is 20 to 1 or 20:1). Most individuals with Type 1 diabetes has a carb ratio close to 10:1. Some individuals, particularly those with Type 2 diabetes or those who are overweight may have carb ratios of 5:1 or even 2:1).

When you are starting out with carb counting, it is safe practice to assume your carb ratio is 15:1 – we choose a high starting carb ratio because we don't want you to have a low sugar after your first dose! To find out your own carb ratio you will have to do a series of simple experiments with your favourite starchy foods.

A small bagel has 30 grams of starch. If your carb ratio is 15 to 1 and you plan to eat a bagel, you will need 30/15 = 2 U of rapid insulin to neutralize the carbs in a single bagel. The ultimate test of whether you got the dose of insulin right (based on carb counting and your carb ratio) is whether the sugar two hours after a meal is in the 6-10 range (or 8-12 one hour after a meal). This also assumes that your blood sugar before the meal started out in the right range (say 5-8). So if you ate the bagel and your sugar was > 10 two hours after the meal it means you didn't take enough insulin and that your carb ratio is less than 15 to 1. Next time you eat the bagel you might want to try a carb ratio of 10 to 1 which would mean you would take 30/10 = 3 units of ultra-short acting insulin. On the other hand if your blood sugar after the bagel was <6 that implies you took too much insulin and your carb ratio is actually higher than you guessed. Note for American readers: to convert blood sugar values discussed in this article to American units multiply by 18.

Note, on average 25-30% more insulin is required at breakfast than for the same amount of starch taken later in the day. So an individual who has a carb ratio of 10:1 for lunch of dinner may need to use a carb ratio of 8:1 or 7:1 for breakfast.

Providing you are doing your carb counting correctly and your sugars after meals are good, your sugar values when you wake and before meals have much more to do with your dose of basal insulin (Lantus or Levemir or NPH). The dose of basal insulin is correct when your sugar when you wake and before meals is in the 5-8 range. If your pre-breakfast readings are consistently above 8 you probably need to increase your basal insulin dose. To be on the safe side you should check your sugar at 2:00 or 3:00 AM to make absolutely sure you are not low – some people have morning highs because they have asymptomatic 2:00 or 3:00 AM lows. If your pre-breakfast readings are consistently less than 5 you need to decrease your basal insulin dose.

Glycemic Index & Glycemic Load

All individuals who practice carb counting notice than some carbs require less insulin than others. This introduces the concept of glycemic index (GI). GI is a ranking of carbohydrates on a scale from 0 to 100 according to the extent to which they raise blood sugar levels after eating. Sugar has a GI of 100. Foods with a high GI (>70 such as potatoes) are those which are rapidly digested and absorbed and result in marked fluctuations in blood sugar levels. Foods with a low GI (<55, such as grains including brown rice, oats, barley, quinoa) are more slowly digested and absorbed and require less insulin. This is a good website for detailed information http://www.glycemicindex.com/foodSearch.php. Strictly speaking when doing carb counting a correction should always be made for GI. This correction is known as the Glycemic Load (GL). GL = #grams X GI/100. Thus the GL of 50 grams of brown rice (GI=46) would be 50*46/100 = 23 while 50 grams of mashed potatoes (GI = 83) would be 50*83/100 = 41. Thus 41/23 (=1.8) times as much rapid insulin would be required for the mashed potatoes.

Corrections

You should always test before taking your mealtime insulin to see whether the previous dose of your basal insulin and/or mealtime insulin was correct. If your sugar is higher than your pre-meal target (usually in the range of 5-8), you may give yourself extra mealtime insulin, above and beyond what you would usually take for the carbs in the upcoming meal. This extra mealtime insulin is called a “correction” or “sliding-scale”. Usual corrections for people with a carb-ratio of 10 or 15:1 would be 1 extra unit for every 2 the sugar is above target. For people with a carb ratio <10:1, a correction of 1 for every 4 the sugar is above target. Thus if your before meal target is 5-8, and your carb ratio is 10:1 & your sugar before a meal is 12.0 you would take 2 a correction of 2 units. Here is the detail for the calculation: sugar now = 12, upper range of target = 8; 12-8 = 4. 4 divided by 2 = 2. Therefore correction dose is 2 units of mealtime insulin.Usual corrections for people with a carb-ratio of 10:1 or 15:1 would be 1 extra unit for every 2 (using mMol/L) that the sugar is above target. For people with a carb ratio <10:1, a correction of 1 for every 4 that the sugar is above target.

As an example for an individual whose before meal target is 5-8 & whose carb ratio is 10:1,

if blood sugar before meal is 12.4, this is 4.4 above target. 4.4 divided by 2 gives 2.2 units. Rounding down this would mean a correction dose of 2 units of rapid would be added to the dose to cover the meal (by carb counting).