**Ratio (insulin: carbohydrate) & Correction**

Ratio is a method replacing the sliding scale and the meal plan. It offers more flexibility at meal time by allowing the adjustment of insulin according to the amount of carbohydrate eaten. The ratio can only be used for a meal covered by rapid-acting insulin (ex: NovoRapid, Humalog). It is not possible to use this technique for a meal covered by intermediate-acting insulin (NPH, Humulin N).

Rapid-acting insulin that is given to cover carbohydrate is called a Meal Bolus or Carbohydrate Bolus. Rapid-acting insulin that is given for a high blood sugar is called a Correction Bolus. These two boluses are calculated separately, but they may be given at the same time. For example, if the blood sugar is high before breakfast, a Correction Bolus would be given in addition to a Carbohydrate Bolus.

If you wish to start this method, please communicate with the nurses in order to get a 0.5 unit pen if you do not have one already. The pen can be delivered by mail.

**Carbohydrate (carb) Bolus**

The **Insulin: carbohydrate Ratio** can be used to decide on the amount of rapid-acting insulin to give for carbohydrate-containing meals or snacks. An Insulin: Carb Ratio estimates the amount of insulin that is needed to cover a specific amount of carbohydrate. For example, a ratio of 1:10 means that 1 unit of rapid-acting insulin is needed for every 10g of carbohydrate.

**« Mom…I am still hungry! »**

It is possible to give a second insulin injection at meal time if your child eats more carbohydrate than expected. (i.e. dessert).

In that situation, only a Carb Bolus should be calculated for the extra carbohydrates. No need for a second Correction Bolus.

Some people need a different ratio for specific meals and snacks. For example, it is common to need more rapid insulin to cover carbohydrate eaten at breakfast than at lunch. It is also quite common to use a smaller amount of rapid insulin for bedtime snacks.

The formula for calculating how much rapid-acting insulin to give for carbohydrate is:

 **Total amount of carbs to be eaten\_\_\_\_\_\_\_**

**Amount of carbs covered by 1 unit of fast-acting insulin**

*Example:*

*Amount of carbs to be eaten = 65g*

*Ratio = 1/10*

*Carbohydrate Bolus = 65g ÷ 10 = 6.5 units*

**Correction Bolus**

For a blood sugar correction, two techniques can be used. The first one is called the **Correction Scale** and the second on is called the **Correction Formula**. The correction scale, is easier to understand, but is less precise than the second technique. The correction formula is favored when your child wants to go on the insulin pump, since it is the technique used by the insulin pump. You should never calculate two corrections within 3 hours.

**To correct or not to correct….that is the question!**

A Correction Bolus should not be given with snacks. Only a Carbohydrate Bolus should be calculated.

Technique 1 : Correction scale

|  |  |
| --- | --- |
| **Blood sugar** | **Rapid-acting insulin (example)** |
| < 4.0 | -1 |
| 4.0 – 8.0 (target value) | 0 (no correction needed) |
| 8.0 – 12.0 | + 1 |
| 12.0 -17.0 | + 2 |
| > 17.0 | + 3 |

Technique 2 : Correction Formula

 **Glycemia – Target\_**

**Insulin sensitivity**

**Glycemia** = Blood sugar value on your glucometer or continuous glucose monitoring system (i.e. Dexcom, Freestyle Libre). It is usually the blood sugar value at meal time.

**Target** = Blood sugar value desired 4h after the injection, when the rapid-acting insulin has completed its action. This target value is 6.0 mmol/L (average of 4.0 mmol/L and 8.0 mmol/L), but could be higher.

**Insulin sensitivity** = Estimation of how much 1 unit of rapid-action insulin will lower the blood sugar. This value must be individually set for each person by your medical team. For example, one person may find that 1 unit of rapid-acting insulin lowers their blood sugar by 2 mmol/L, while another person may find that 1unit of rapid-acting insulin lowers their blood sugar by 7 mmol/L.

*Example :*

*Current Blood Sugar = 12.8 mmol/L*

 *Target Blood Sugar = 6.0 mmol/L*

 *Insulin Sensitivity = 5.0 mmol/L*

 Correction Bolus = (12.8 – 6) ÷ 5 = 6.8 ÷ 5 = 1.36 units

To practice, we suggest that you always calculate a Correction Bolus at meal time even if the blood sugar is between 4.0 mmol/L and 8.0 mmol/L.

**« Dad, I am low! »**

If the blood sugar is less than 4.0 mmol/L at meal time (hypoglycemia), it is important to do the proper treatment, wait 15 minutes and re-test the blood sugar.

To calculate the Correction Bolus, use the hypoglycemia value in the Correction Formula or subtracts the recommended amount of insulin suggested by the sliding scale. In the event of a hypoglycemia at meal time, insulin should be subtracted from the Carbohydrate Bolus to limit the risk of another hypoglycemia post-meal.

**Total Bolus**

The Total Bolus is the total dose of rapid insulin given before the meal. It is the addition of the Carbohydrate Bolus and the Correction Bolus.

When calculating the Carbohydrate Bolus and the Correction Bolus, keep all decimals (numbers placed to the right of a comma). For safety reason, we suggest rounding down the Total Bolus (i.e. Total Bolus = 4.79 units = 4.5 units).

|  |
| --- |
| **Carbohydrate Bolus + Correction Bolus = Total Bolus**  |



**Let’s practice**

**Example 1:** How much insulin would you give?

Carbohydrates  = 45g

Carbohydrate Bolus =

Correction Bolus =

Total Bolus =

Ratio (insulin: carb) = 1/15

Target = 8.0 mmol/L

Insulin Sensitivity = 4

Glycemia = 14.2 mmol/L

**Example 2:** How much insulin would you give?

Carbohydrates = 80g

Carbohydrate Bolus =

Correction Bolus =

Total Bolus =

Ratio (insulin : carb) = 1/30

Target = 6.0 mmol/L

Insulin Sensitivity = 5

Glycemia = 3.6 mmol/L

**Example 3:** How much insulin would you give?

Carbohydrates = None

Carbohydrate Bolus =

Correction Bolus =

Total Bolus =

Ratio (insulin : carb) = 1/7

Target = 6.0 mmol/L

Insulin Sensitivity = 2

Glycemia = 19.6 mmol/L

(≠ ketone)