Calculating Insulin Dose

First, some basic things to know about insulin:

- **Approximately 40-50% of the total daily insulin dose is to replace insulin overnight, when you are fasting and between meals.** This is called background or basal insulin replacement. The basal or background insulin dose usually is constant from day to day.
- **The other 50-60% of the total daily insulin dose is for carbohydrate coverage (food) and high blood sugar correction**. This is called the bolus insulin replacement.

Bolus – Carbohydrate coverage

The bolus dose for food coverage is prescribed as an insulin to carbohydrate ratio. The insulin to carbohydrate ratio represents how many grams of carbohydrate are covered or disposed of by 1 unit of insulin.

Generally, one unit of rapid-acting insulin will dispose of 12-15 grams of carbohydrate. This range can vary from 6-30 grams or more of carbohydrate depending on an individual's sensitivity to insulin. Insulin sensitivity can vary according to the time of day, from person to person, and is affected by physical activity and stress.

Bolus – High blood sugar correction
(also known as insulin sensitivity factor)

The bolus dose for high blood sugar correction is defined as how much one unit of rapid-acting insulin will drop the blood sugar.

Generally, to correct a high blood sugar, one unit of insulin is needed to drop the blood glucose by 50 mg/dl. This drop in blood sugar can range from 30-100 mg/dl or more, depending on individual insulin sensitivities, and other circumstances.

Examples:

Read some examples and therapeutic principles on how to calculate the carbohydrate coverage dose, high blood sugar correction dose and the total mealtime insulin dose.

Example #1: Carbohydrate coverage at a meal

First, you have to calculate the carbohydrate coverage insulin dose using this formula:

CHO insulin dose = Total grams of CHO in the meal ÷ grams of CHO disposed by 1 unit of insulin
(the grams of CHO disposed of by 1 unit of insulin is the bottom number or denominator of the Insulin: CHO ratio).

For Example #1, assume:

- You are going to eat 60 grams of carbohydrate for lunch
- Your Insulin: CHO ratio is 1:10

To get the CHO insulin dose, plug the numbers into the formula:

CHO insulin dose = Total grams of CHO in the meal (60 g) ÷ grams of CHO disposed by 1 unit of insulin (10) = 6 units

You will need 6 units of rapid acting insulin to cover the carbohydrate.

Example #2: High blood sugar correction dose

Next, you have to calculate the high blood sugar correction dose.

High blood sugar correction dose = Difference between actual blood sugar and target blood sugar* ÷ correction factor.

**Actual blood sugar minus target blood sugar*

For Example #2, assume:

- 1 unit will drop your blood sugar 50 points (mg/dl) and the high blood sugar correction factor is 50.
- Pre-meal blood sugar target is 120 mg/dl.
- Your actual blood sugar before lunch is 220 mg/dl.

Now, calculate the difference between your actual blood sugar and target blood sugar:

220 minus 120 mg/dl = 100 mg/dl

To get the high blood sugar correction insulin dose, plug the numbers into this formula:

Correction dose = Difference between actual and target blood glucose (100mg/dl)
÷ correction factor (50) = 2 units of rapid acting insulin

So, you will need an additional 2 units of rapid acting insulin to "correct" the blood sugar down to a target of 120 mg/dl.

Example #3: Total mealtime dose

Finally, to get the total mealtime insulin dose, add the CHO insulin dose together with the high blood sugar correction insulin dose:

CHO Insulin Dose
+ High Blood Sugar Correction Dose
= Total Meal Insulin Dose

For Example #3, assume:

- The carbohydrate coverage dose is 6 units of rapid acting insulin.
- The high blood sugar correction dose is 2 units of rapid acting insulin.

Now, add the two doses together to calculate your total meal dose.

Carbohydrate coverage dose (6 units)
+ high sugar correction dose (2 units)
= 8 units total meal dose!

The total lunch insulin dose is 8 units of rapid acting insulin.

Example #4: Formulas commonly used to create insulin dose recommendations

This example illustrates a method for calculating of your background/basal and bolus doses and estimated daily insulin dose when you need full insulin replacement. Bear in mind, this may be too much insulin if you are newly diagnosed or still making a lot of insulin on your own. And it may be too little if you are very resistant to the action of insulin. Talk to your provider about the best insulin dose for you as this is a general formula and may not meet your individual needs.

The initial calculation of the basal/background and bolus doses requires estimating your total daily insulin dose:

Total Daily Insulin Requirement:

The general calculation for the body's daily insulin requirement is:

Total Daily Insulin Requirement (in units of insulin)
= Weight in Pounds ÷ 4

Alternatively, if you measure your body weight in kilograms:

Total Daily Insulin Requirement (in units of insulin)
= 0.55 X Total Weight in Kilograms

Example 1:

If you are measuring your body weight in pounds:

- Assume you weigh 160 lbs.

In this example:

TOTAL DAILY INSULIN DOSE
= 160 lb ÷ 4 = 40 units of insulin/day

Example 2:

If you are measuring your body weight in kilograms:

- Assume your weight is 70Kg

In this example:

TOTAL DAILY INSULIN DOSE
= 0.55 x 70 Kg = 38.5 units of insulin/day

If your body is very resistant to insulin, you may require a higher dose. If your body is sensitive to insulin, you may require a lower insulin dose.

Basal/Background and Bolus Insulin Doses

Next, you need to establish the basal/background dose, carbohydrate coverage dose (insulin to carbohydrate ratio) and high blood sugar correction dose (correction factor).

Basal/background insulin dose:

Basal/background Insulin Dose
= 40-50% of Total Daily Insulin Dose

Example:

1. Assume you weigh 160 pounds
2. Your total daily insulin dose (TDI) = 160 ÷ 4 = 40 units.

In this example:

Basal/background insulin dose
= 50% of TDI (40 units) = 20 units
of either long acting insulin, (such as glargine or detemir) or rapid acting insulin if you are using an insulin pump (continuous subcutaneous insulin infusion device).

The carbohydrate coverage ratio:

500 ÷ Total Daily Insulin Dose
= 1 unit insulin covers so many grams of carbohydrate

This can be calculated using the Rule of "500": Carbohydrate Bolus Calculation

In this example:

Carbohydrate coverage ratio
= 500 ÷ TDI (40 units)
= 1unit insulin/ 12 g CHO

This example above assumes that you have a constant response to insulin throughout the day. In reality, individual insulin sensitivity varies. Someone who is resistant in the morning, but sensitive at mid-day, will need to adjust the insulin-to-carbohydrate ratio at different meal times. In such a case, the background insulin dose would still be approximately 20 units; however, the breakfast insulin-to-carbohydrate ratio might be breakfast 1:8 grams, lunch 1:15 grams and dinner 1:12 grams.

The insulin to carbohydrate ratio may vary during the day.

The high blood sugar correction factor:

Correction Factor = 1800 ÷Total Daily Insulin Dose = 1 unit of insulin will reduce the blood sugar so many mg/dl

This can be calculated using the Rule of "1800".

Example:

1. Assume your total daily insulin dose (TDI) = 160 lbs ÷ 4 = 40 units

In this example:

Correction Factor
= 1800 ÷ TDI (40 units)
= 1 unit insulin will drop reduce the blood sugar level by 45 mg/dl

While the calculation is 1 unit will drop the blood sugar 45 mg/dl, to make it easier most people will round up or round down the number so the suggested correction factor may be 1 unit of rapid acting insulin will drop the blood sugar 40-50 mg/dl.

Please keep in mind, the estimated insulin regimen is an initial "best guess" and the dose may need to be modified to keep your blood sugar on target.

Also, there are many variations of insulin therapy. You will need to work out your specific insulin requirements and dose regimen with your medical provider and diabetes team.

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