



## **PATIENT INFORMATION**

### **How to adjust insulin doses**

Firstly it is important to understand how the different types of insulin work.

#### **Basal insulin** –usually Lantus or Levemir

This is the background insulin, it keeps the blood glucose levels steady between meals, and overnight.

Lantus is usually given once a day, and works for 20 – 24 hours.

Levemir may be given once or twice daily as it works for 12 – 16 hours.

#### **Bolus insulin** – usually Novorapid, or Humalog

This is the insulin given with meals and any snacks containing carbohydrates (carbs). It starts to work within 10 minutes of being injected, peaking at 1 – 2 hours and has stopped working by 3 – 4 hours.

#### **Insulin to carb ratio**

This is the number of grams (g) of carbs covered by 1 unit of bolus insulin.

The ratio is written as 1unit : X grams carbs

**Dose of bolus insulin (units) = amount of carbs eaten (grams), divided by the number of grams covered by 1 unit of insulin**

Example:

Plan to eat 60g carbs

Ratio 1 unit : 20g carbs

Dose = 60g divided by 20g

= 3 units (Novorapid or Humalog)

#### **Blood target (BG) target**

When using a meter the target range will be set at 4 – 7 mmol (millimoles) as this is what you are aiming for on waking up in the morning and before meals.

#### **Correction factor / Insulin sensitivity**

If the blood glucose level is above the target range pre-meal additional insulin will be needed to bring it back into the target range.

The **insulin sensitivity ratio** (correction) = how many mmol 1 unit of fast-acting insulin will make glucose level drop by. It is written 1unit: **X** mmols

Example:

Firstly, you need to work out how much the glucose needs to come down by:

So, if 16mmols before a meal and you want to bring down to 6mmol

$$16 - 6 = 10 \text{ mmols}$$

Ratio 1 unit : **5** mmols

Dose = 10mmols divided by the ratio which is **5**  
= 2 units

When a meter is used to calculate the bolus dose of insulin for a meal or snack, it will take into account the blood glucose level, the carbs to be eaten and the target range.

### How do I make adjustments to insulin doses?

The key to managing blood glucose levels well is to review the levels regularly either by downloading the meter onto Diasend, or by keeping a written glucose record diary.

#### Remember the 3 golden rules:

- Make 1 adjustment at a time
- Make small adjustments
- Review blood glucose levels 2 -3 days after making the change, to see the effect of the change, if it hasn't worked don't worry try another adjustment

#### Adjusting the BASAL (long-acting ) insulin

Basal insulin should keep the blood glucose level steady overnight with very little change between the reading before bed, and on waking in the morning. It should also help to keep the pre-meal levels in target.

In the table below, the blood glucose level is rising overnight:

	Before breakfast	Before lunch	Before evening meal	Bed time
<b>Mon</b>				<b>6.5</b>
<b>Tue</b>	<b>10</b> ←			<b>5.2</b>
<b>Wed</b>	<b>9</b> ←			<b>4.8</b>
<b>Thur</b>	<b>7.5</b> ←			<b>7.2</b>
<b>Fri</b>	<b>11</b> ←			

If this happens several nights a week it would suggest that the basal insulin dose is too low, and will need to be increased. Remember if it is happening most nights the change should be made.

In the table below, the blood glucose level is falling overnight:

	Before breakfast	Before lunch	Before evening meal	Bed time
Mon				11.2
Tue	6.9			6.9
Wed	3.1			7.2
Thur	3.8			10.2
Fri	5.4			

If this happens several nights a week it would suggest that the basal insulin dose is too high, and will need to be reduced.

**Guide to increasing/decreasing insulin the long acting insulin:**

Current dose	Recommended change
10 units or less	Increase/ decrease by 0.5 units (half a unit)
10-20 units	Increase/ decrease by 1 –1.5 units
20-30 units	Increase/ decrease by 2 – 2.5 units
More than 30 units	Increase/ decrease by 3 - 4 units

**Adjusting rapid acting insulin (Novorapid)**

To check if the bolus dose of insulin is correct, you need to look at the blood glucose levels before, and 2 hours after a meal.

**Note:** It is important that the level is in the target range before the meal to do this effectively.

If you notice a pattern where the blood glucose repeatedly goes up or down 2 hours after a meal, by 2mmols or more, you may need to adjust the insulin to carb ratio.

You should also consider the following before making changes:

- Is carb counting accurate?
- Are injection sites lumpy?
- Are the injections being given 10 – 20 minutes before the meal?
- Was any exercise taken during this time? How was it managed?
- Have any injections been missed?

**Guide to adjusting the BOLUS dose of insulin**

The bolus dose is adjusted by changing the insulin: carb ratio.

BG rising 2 hours after meal	Action Required	Suggested ratio change
If blood glucose rises by more than 2 mmol above the pre-meal reading	Decrease the number of grams of carbs that 1 unit of insulin will cover	1: 5 g carbs → 1: 4 g
		1: 8 g → 1: 6 g
		1:10 g → 1: 8 g
		1: 15 g → 1: 12 g
		1: 20 g → 1: 18 g
		1: 25 g → 1: 20 g
		1: 30 g → 1: 25 g
		1: 35 g → 1: 30 g

**Remember:**

The **smaller** the number of grams of carbohydrate per 1 unit of insulin, the **bigger** the dose

BG falling 2 hours after meal	Action Required	Suggested ratio change
If blood glucose falls by more than 2mmol below the pre-meal reading	Increase the number of grams of carbs that 1 unit will cover	1: 4 g carbs → 1: 5 g 1: 6 g → 1: 8 g 1: 8 g → 1:10 g 1: 12 g → 1: 15 g 1: 18 g → 1: 20 g 1: 20 g → 1: 25 g 1: 25 g → 1: 30 g 1: 30 g → 1: 35 g
<b>Remember:</b> The <b>bigger</b> the number of grams of carbohydrate per 1 unit of insulin, the <b>smaller</b> the dose		

**Examples:**

If the ratio is 1 : 5g, you would have 1 unit of insulin for every 5 grams of carbs, so a meal containing 20grams would need  
 20 grams (carbs) ÷ 5 (the ratio) = 4 units insulin

BUT

If the ratio were 1: 4g, you would have 1 unit of insulin for every 4 grams of carbs, so a meal containing 20grams would need  
 20 grams (carbs) ÷ 4 (the ratio) = 5 units insulin

Here are some further examples of how to look at the diary or download on Diasend:

In this example blood glucose levels rise after breakfast; **which suggests the Novorapid before breakfast needs to be increased, by adjusting the insulin to carb ratio.**

Before breakfast	After breakfast	Before lunch	After lunch	Before evening meal	After evening meal
4.2 →	8.6	5.8	6.4	11.2	10.1
5.1 →	10.2	8.2	9.9	9.4	9.9
6.9 →	11.0	7.5	7.3	6.2	7.1
7.5 →	12	6.2	7.7	5.4	3.8

In this example blood glucose levels rise after the evening meal; **the Novorapid before the evening meal needs to be increased by adjusting the ratio.**

Before breakfast	After breakfast	Before lunch	After lunch	Before evening meal	After evening meal
6.7	8.0	5.4	6.8	4.5 →	8.1
7.3	7.9	9.9	11.2	6.7 →	11.2
9.2	6.3	11.2	8.7	6.1 →	6.8
6.8	6.1	4.5	3.1	5.9 →	9.6
6.7	5.7	4.1	6.7	6.6 →	10.2

Here blood glucose levels are falling after lunch; **the Novorapid dose before lunch needs to be reduced, by adjusting the ratio.**

Before breakfast	After breakfast	Before lunch	After lunch	Before evening meal	After evening meal
6.2	5.8	7.2 →	4.1	7.9	6.3
5.5	6.8	5.6 →	3.5	8.1	10
9.6	10.5	4.9 →	3.1	5.5	6.2
5.9	11.2	10.3	6.1	5.8	6.9
7.0	6.9	6.7 →	6.3	4.2	5.4