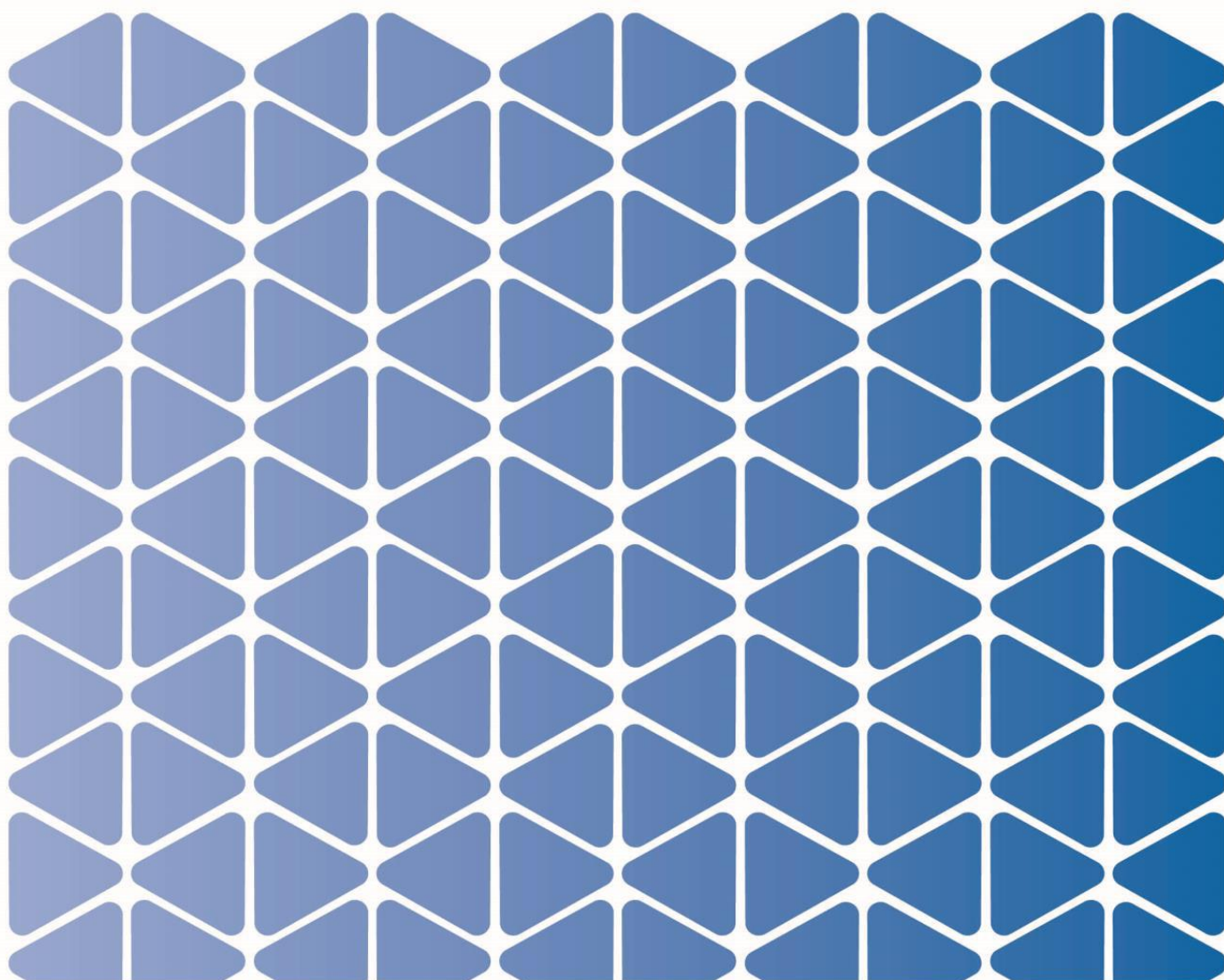


PATIENT INFORMATION

CARBOHYDRATE COUNTING AND INSULIN DOSE ADJUSTMENT



The Nutrition and Dietetic Department contact numbers:

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Your Dietitian.....

The insulin dose adjustment is the next step in learning carbohydrate counting.

In the first 2 steps of carbohydrate counting, explained in the previous leaflet, you would have learned to identify the carbohydrate rich foods and estimate the amount of carbohydrate in these foods using food labels and Carbohydrate Reference Tables.

Once you know how to estimate the carbs in your meals, it is now time to learn how to adjust your insulin dose according to the amount of carbs at your meal, which is Step 3 of carbohydrate counting.

Step 3

Calculate the insulin dose

The appropriate insulin dose at your meal is worked out using the **carbohydrate content of your meal** in grams divided by your personal **insulin to carbohydrate ratio (ICR)**.

The **ICR** specifies the number of grams of carbohydrate that is covered by each unit of rapid acting insulin. The ICR is different for everyone and may vary depending on the time of day. These ratios also may change over time when you are growing and going through puberty.

For example:

Your ICR may be: **1 unit of rapid insulin to 10 grams of carbs (ICR 1:10)** or
1 unit of rapid insulin for 15 grams of carbs (ICR 1:15) or
1 unit of rapid insulin for 8 grams of carbs (ICR 1:8)

Your diabetes team will work out your ICR for you.

Once you are given your ICR, you will use it to calculate how much insulin you need at a meal depending on the amount of carbohydrate in that meal.

Basically you divide the amount of carbs in grams by the ICR.

$$\begin{array}{|c|} \hline \text{Carbohydrate} \\ \text{content of your} \\ \text{meal in grams} \\ \hline \end{array} \div \begin{array}{|c|} \hline \text{Your} \\ \text{insulin to carbohydrate ratio} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Insulin dose for the} \\ \text{carbohydrate} \\ \hline \end{array}$$

For example: if you having 60g of carbs and your ICR is 1:10, you divide 60 by 10 which gives you an insulin dose of 6 units.

Use your **insulin to carbohydrate ratio** to work out how much insulin you need to take to cover the carbohydrate in your meals or snacks.

Work out insulin dose using insulin to carbohydrate ratio:

e.g. If the ratio is 1:12, how much insulin is needed for 30g of carbohydrate?

e.g. If the ratio is 1:12, how much insulin is needed for 150g of carbohydrate?

INSULIN CALCULATOR

You may want to use the insulin calculator to find (without using an actual calculator) the dose of insulin you need for different amount of carbs using your ICR.

On the top bar of the table across you find your IRC for that meal and on the bar on the left hand side find the amount of carbs. To find your insulin dose slide your finger down the column which has your OCR on the top until the row which has the amount of carbs. For example: if your ICR is 1:15 and you have 100g of carbs, the insulin dose is 6.5 units.

Carbohydrate in grams ↓

	1:35	1:30	1:25	1:20	1:18	1:15	1:12	1:10	1:8	1:7	1:5	1:3
10	0	0	0.5	0.5	0.5	0.5	1	1	1	1.5	2	3.5
20	0.5	0.5	1	1	1	1	1.5	2	2.5	3	4	6.5
30	1	1	1.5	1.5	1.5	2	2.5	3	3.5	4	6	10
40	1	1	2	2	2	2.5	3	4	5	5.5	8	13
50	1.5	1.5	2.5	2.5	2.5	3	4	5	6	7	10	16.5
60	1.5	2	3	3	3	4	5	6	7.5	8.5	12	20
70	2	2	3.5	3.5	4	4.5	5.5	7	8.5	10	14	23
80	2	2.5	4	4	4.5	5	6.7	8	10	11.5	16	26.5
90	2.5	3	4.5	4.5	5	6	7.5	9	11	13	18	30
100	3	3	5	5	5.5	6.5	8	10	12.5	14	20	33
110	3	3.5	5.5	5.5	6	7	9	11	13.5	15.5	22	36.5
120	3.5	4	6	6	6.5	8	10	12	15	17	24	40
130	3.5	4	6.5	6.5	7	8.5	10.5	13	16	18.5	26	43.5
140	4	4.5	7	7	7.5	9	11	14	17.5	20	28	46.5
150	4	5	7.5	7.5	8	10	12.5	15	18.5	21.5	30	50
160	4.5	5	8	8	8.5	10.5	13	16	20	23	32	53.5
170	5	5.5	8.5	8.5	9.5	11	14	17	21	24.5	34	56.5
180	5	6	9	9	10	12	15	18	22.5	25.5	36	60
190	5.5	6	9.5	9.5	10.5	12.5	15.5	19	23.5	27	38	63.5
200	5.5	6.5	10	10	11	13	16.5	20	25	28.5	40	66.5

Now have a go at working out your insulin dose for different meals based on your ICR and the amount of carbs in your meal. Either use the 'insulin calculator' on the previous page or use your calculator to divide the amount of carbs in your meal by your ratio to find the insulin dose.

What is your insulin to carbohydrate ration for breakfast?

How many units of insulin do you need for:

30g carbohydrate:_____

50g carbohydrate:_____

100g carbohydrate:_____

What is your insulin to carbohydrate ration for lunch?

How many units of insulin do you need for:

50g carbohydrate:_____

80g carbohydrate:_____

120g carbohydrate:_____

What is your insulin to carbohydrate ration for evening meal?

How many units of insulin do you need for:

60g carbohydrate:_____

90g carbohydrate:_____

180g carbohydrate:_____

How to work out the correction dose:

The 'correction' is used when your blood glucose level is high to work out the amount of insulin needed to bring your blood glucose to a normal level.

You will use the '**insulin sensitivity factor**', also called the '**correction factor**', which is an estimation of how much 1 unit of rapid acting insulin will lower your blood glucose level.

This correction factor is specific for each person as it usually depends on the average daily dose of insulin that the person needs.

Your diabetes team will calculate your 'correction factor' and to you how to use it.

Write your correction factor below:

1 unit of rapid insulin lowers blood glucose by mmol/L

When you know your insulin sensitivity factor, you can work out your 'correction bolus', which is the insulin dose you need to lower your blood glucose to a normal level:

$$\begin{array}{|c|} \hline \text{Current blood} \\ \text{glucose} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{Target blood} \\ \text{glucose} \\ \hline \end{array} \div \begin{array}{|c|} \hline \text{Insulin} \\ \text{sensitivity} \\ \text{factor} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Correction bolus} \\ \hline \end{array}$$

Your target range will normally be 8 mmol/L.

***Remember to check blood ketones if blood glucose is above 14 mmol/l**

Example:

Calculate correction bolus if your blood glucose is 16 mmol/l, target blood glucose 8 mmol/L and correction factor is 1:2 mmol/l.

$$\begin{array}{|c|} \hline 16 \text{ mmol/L} \\ \hline \end{array} - \begin{array}{|c|} \hline 8 \text{ mmol/L} \\ \hline \end{array} \div \begin{array}{|c|} \hline 2 \\ \hline \end{array} = \begin{array}{|c|} \hline 4 \text{ units} \\ \hline \end{array}$$

Current blood glucose target blood glucose correction factor correction bolus

Now practice working out the correction bolus:

Pre-meal blood glucose: 18 mmol/L

Target blood glucose: 8 mmol/L

Insulin sensitivity factor: 1 : 5 mmol/L

$$\boxed{} - \boxed{} \div \boxed{} = \boxed{}$$

Current blood glucose target blood glucose correction factor correction bolus

Guidelines and caution for using correction boluses:

- Check blood glucose 2-3 hours after giving correction bolus
- Do NOT give correction bolus less than your target range
- Do NOT correct if it has been less than 2 hours since your last correction bolus
- If a correction bolus is given between meals, the dose may need to be lower
- Do NOT correct a high blood glucose if you had a hypo in the last 4-6 hours
- If your blood glucose meter has the correction dose programmed in, check your settings!

Calculate total insulin dose, including insulin for the meal and the correction dose

To calculate the total mealtime insulin dose you need to work out the amount of insulin you need for the carbohydrate using your insulin to carbohydrate ratio and if your blood glucose levels are high then you need to add the correction bolus (correction dose).

$$\boxed{\text{Insulin dose for the carbohydrate in the meal}} + \boxed{\text{Correction bolus}} = \boxed{\text{Insulin dose}}$$

Example:

Work out the insulin bolus for this meal:

Insulin to carbohydrate ratio: 1 unit to 10g CHO

Total amount of carbs in the meal: 30g

CHO bolus: $30\text{g} \div 10\text{g} = 3$ units of rapid insulin

Then work out the correction dose:

Pre-meal blood glucose: 14mmol/L.

Target blood glucose level: 8mmol/L

Insulin sensitivity factor: 1u : 2mmol/L

Correction bolus: $(14 - 8) \div 2 = 3$ units of rapid acting insulin

Now add the insulin bolus for the meal and the 'correction dose':

3 units (for food) + 3 units (correction bolus) = 6 units (total insulin dose)

Whenever possible give rapid acting insulin before a meal.
This prevents the large blood glucose spikes between meals.
This will help to decrease your HbA1c!

Step 4

Consider adjustment for physical activity

Physical activity:

- You may need a snack of 15 to 30 g carbohydrate for every 30 to 60 minutes of exercise, depending on the exercise intensity.
The duration and intensity of exercise will affect the amount of carbohydrate that you need.
- If the exercise is more than 30 minutes and it is quite intense, you may need to reduce the doses of your rapid acting insulin.
- If you are planning to be physically active soon after the meal, you can consider reducing your insulin dose at that meal, which will give you more energy for the exercise and you may not need a snack.
- You may need to reduce your rapid acting insulin dose at a meal after the physical activity to have enough glucose to replenish the muscle stores and prevent a hypo.
- Discuss this further with your Diabetes Team.

Step 5

Adjust insulin doses

When you have learned carbohydrate counting and you are able to adjust insulin doses according to your blood glucose levels, it is important to also learn to adjust the ICR to get accurate insulin doses and keep blood glucose levels in range.

In order to adjust insulin doses, you need to know which insulin has an effect on your blood glucose at what time. Have a look at this table:

Insulin time	Effects blood glucose
Evening: background insulin (Lantus/Levemir)	Overnight and before breakfast
Breakfast: rapid acting (Novorapid/Humalog/Apidra)	2 hours after breakfast and before lunch
Lunch: rapid acting (Novorapid/Humalog/Apidra)	2 hours after lunch and before evening meal
Evening meal: rapid acting (Novorapid/Humalog/Apidra)	2 hours after evening meal and before bed

Adjusting the ICR according to blood glucose levels:

Your diabetes team will help you with adjusting the ICR initially, but in long term it would be good for you to know how to do that by yourself, or at least to know when you need to highlight to your diabetes team that you think your ratios need to be altered.

- To test if your ICR is well adjusted you will need to choose a day when your blood glucose level is below 10 mmol/l, no hypos in the previous 12 hours and no strenuous physical activity on that day.
- For testing your ICR choose meals that are balanced if possible, meaning that the meal has a moderate amount of carbs, some vegetables and is not too high in fat.
- You need to carb count as accurately as you can and then calculate your insulin dose using your current ICR.
- Check your blood glucose before the meal. You can test your ratio when your blood glucose is anywhere between 4 to 10 mmol/l. Do not give a correction dose, just the insulin to cover the carbohydrate. If your blood glucose is above 10 mmol/l you would not be able to test your ICR at that meal, as you would need to give a correction, therefore the ICR test would not be accurate.
- You then need to test your blood glucose about 4 hours later, without having any carbs inbetween.
- If your blood glucose is within 2 mmol/l to what it was before the meal, it means your ICR is well adjusted.
- If there is more than 2 mmol/l difference between blood glucose before the meal and 4 hours later, it means that you probably need to adjust the ICR. To be sure that the ICR needs adjusting, it would be advisable to repeat the ICR test once or twice before making any changes.

Adjusting the insulin to carbohydrate ratios:

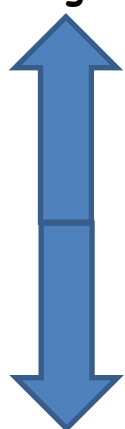
Over time the amount of carbohydrate you need for each unit of insulin may change.

You can adjust your ratios for each meal by looking at patterns in your blood glucose levels.

Use this scale to find out which way.

Move this way if
blood glucose
levels are too

high



Move this way if
blood glucose
levels are too
low

Insulin to carbohydrate ratio
1 unit to 3g
1 unit to 5g
1 unit to 6g
1 unit to 7g
1 unit to 8g
1 unit to 9g
1 unit to 10g (½ unit to 5g)
1 unit to 12g (½ unit to 6g)
1 unit to 14g (½ unit to 7g)
1 unit to 16g (½ unit to 8g)
1 unit to 18g (½ unit to 9g)
1 unit to 20g (½ unit to 10g)
1 unit to 25g (½ unit to 12.5g)
1 unit to 30g (½ unit to 15g)
1 unit to 35g (½ unit to 17.5g)
1 unit to 40g (½ unit to 20g)

How to test that your insulin to carb ratio is fine:

- Test your blood glucose before a meal
You should not have given any insulin boluses during the previous 4 hours before this meal
- Make sure you counted the carbs correctly
- Give your usual insulin to carb bolus
- Check your blood glucose 4 hours after your meal
- Your blood glucose 4 hours after the meal should be within the target level
- If the blood glucose 4 hours after the meal is out of target, review your insulin to carb ratio
- If at any stage during the test you have a hypo, stop the test, treat the hypo and repeat the test on another occasion

Your diabetes team will help you to calculate your insulin to carbohydrate ratio and will show you how to adjust it according to your blood glucose levels

If your symptoms or condition worsens, or if you are concerned about anything, please call your GP, 111, or 999.

Patient Experience

We know that being admitted to hospital can be a difficult and unsettling time for you and your loved ones. If you have any questions or concerns, please do speak with a member of staff on the ward or in the relevant department who will do their best to answer your questions and reassure you.

Feedback

Feedback is really important and useful to us – it can tell us where we are working well and where improvements can be made. There are lots of ways you can share your experience with us including completing our Friends and Family Test – cards are available and can be posted on all wards, departments and clinics at our hospitals. We value your comments and feedback and thank you for taking the time to share this with us.

Patient Advice and Liaison Service (PALS)

If you have any concerns or questions about your care, we advise you to talk with the nurse in charge or the department manager in the first instance as they are best placed to answer any questions or resolve concerns quickly. If the relevant member of staff is unable to help resolve your concern, you can contact the PALS Team. We offer informal help, advice or support about any aspect of hospital services & experiences.

Our PALS team will liaise with the various departments in our hospitals on your behalf, if you feel unable to do so, to resolve your problems and where appropriate refer to outside help.

If you are still unhappy you can contact the Complaints Department, who can investigate your concerns. You can make a complaint orally, electronically or in writing and we can advise and guide you through the complaints procedure.

How to contact PALS:

Telephone Patient Services: 0300 123 1732 or via email at: wah-tr.PALS@nhs.net

Opening times:

The PALS telephone lines are open Monday to Friday from 8.30am to 4.00pm. Please be aware that you may need to leave a voicemail message, but we aim to return your call within one working day.

If you are unable to understand this leaflet, please communicate with a member of staff.