



**University Hospitals Birmingham**  
NHS Foundation Trust



# Carbohydrate counting and insulin dose adjustment

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## Your insulin

Quick acting / bolus .....

Background / basal .....

## Your Insulin to Carbohydrate Ratio (ICR)

Morning .....

Afternoon .....

Evening .....

Snacks .....

## Your Insulin Sensitivity Factor (ISF)

.....

## Your target blood glucose levels

Before breakfast .....

Before other meals .....

Before bed .....

## Carbohydrate and diabetes

Foods that contain starch and sugar are collectively called carbohydrates. When digested, these foods are broken down to glucose and absorbed into the bloodstream. Carbohydrates are important as they provide our bodies with energy needed to function. For people with diabetes, eating large amounts of these foods will increase blood glucose levels because there is not enough insulin working in your body.

## Why count carbohydrate?

Carbohydrate is the main nutrient that affects blood glucose levels. Carbohydrate counting allows insulin to be matched to the food eaten. By estimating your carbohydrate intake, you can learn to predict your blood glucose response to different foods.

The following advice will help you decide how to make adjustments to your insulin and/or carbohydrate intake giving you greater flexibility around your mealtimes and the foods you choose to eat.

### **Please note:**

**If you have type 1 diabetes we recommend you book a place on either the Dose Adjustment For Normal Eating (DAFNE) or Heart of England Type 1 Education (HET1E) course.**

## Will I need to change my diet?

Your carbohydrate intake will continue to be based on what you eat at present. Your dietitian will be able to help you estimate the carbohydrate content of your meals and snacks. You will not need to make changes to your diet though you are encouraged to follow a balanced, varied diet.

## How do I count carbohydrate?

There are a number of ways to estimate (or count) your carbohydrate. This includes counting portions, using tables in books or websites and reading food labels.

# Carbohydrate Portions

A 'carbohydrate portion' is 10g of carbohydrate - counting portions will give you a quick estimate of how much you are eating. Examples of foods that contain 1 carbohydrate portions include;

<b>Food group</b>	<b>1 Carbohydrate portion (10g) =</b>
Starchy Carbohydrate	1 egg-size potato  1 tablespoon (30g) cooked rice/pasta  1 small/thin slice bread
Liquid Dairy	1/3 pint (200ml) milk  1 small pot (150g) yoghurt
Fruit	1 small apple  1/2 medium banana
Snacks	1 Digestive biscuit  1 small scoop ice cream  1 fun-size chocolate bar
Sugar & Sugary Foods	1 teaspoon jam/honey

## Food labels & other resources

When estimating/counting carbohydrate using food labels or other resources remember to use the figure for TOTAL carbohydrate, not just the sugars.

Food tables often give carbohydrate values in two ways:

Per serving/portion; if you prefer to use 'per serving/portion' you will need to check that your portion matches those given

Per 100g; if you prefer to use 'per 100g' you need to know the weight of the portion you are having to calculate the CHO content.

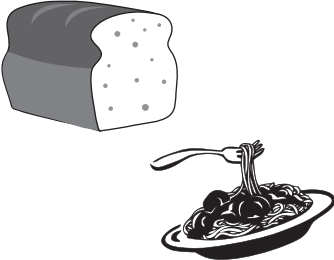
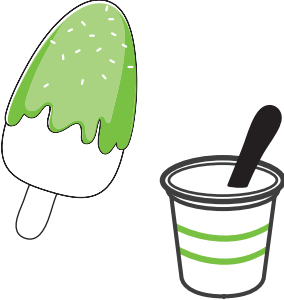

Example: For 87g cooked rice (CHO content = 30g per 100g)

$$\frac{30}{100} \times 87 = 26\text{g CHO}$$



Insulin required 2-3 units

**In time, with practice and by using handy measures you will learn to estimate the carbohydrate content of foods.** Even when counting carbohydrate accurately, there will be occasions where your blood sugar levels are outside of your individual target levels – either above or below target.


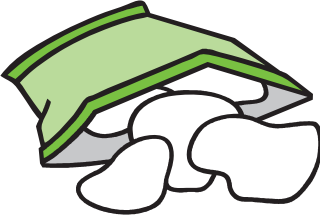
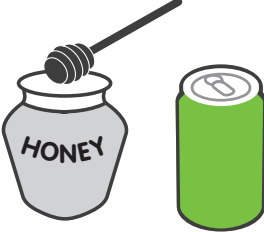
## Foods Needing Insulin

Starchy foods	Liquid dairy foods	Fruit
<p>These foods often form the basis of meals;</p> <p>Potatoes, chips, rice, breakfast cereals, bread, chapattis, noodles, pasta</p>  <p>These usually raise your blood sugar levels slowly</p>	<p>These foods contain a milk sugar called lactose;</p> <p>Milk, yoghurts, ice cream</p>  <p>These usually raise your blood sugar levels quite slowly</p>	<p>Whether dried or fresh, most are naturally sweet;</p> <p>Apple, orange, banana, strawberries, mango</p>  <p>These usually raise your blood sugar levels quite quickly</p>



## Foods Not Needing Insulin - these foods do not significantly affect your blood sugar

Protein Foods	Vegetables
<p>Any meat, chicken or fish without a coating</p> <ul style="list-style-type: none"> <li>• Eggs</li> <li>• Cheese</li> <li>• Nuts</li> <li>• Lentils</li> <li>• Beans</li> </ul> <p>(Baked beans in tomato sauce will need 1 unit per half large/400g tin)</p> 	<p>Any vegetables (except potatoes) frozen or tinned including;</p> <ul style="list-style-type: none"> <li>• Sweetcorn</li> <li>• Peas</li> <li>• Tomatoes</li> <li>• Peppers</li> </ul> 

**Please note - although these foods contain carbohydrate they DO NOT normally need insulin**

Fruit	Snack foods	Sugary foods
<p>or fresh, fruit is</p> <p>raisins, ango</p>  <p>ise your blood e slowly</p>	<p>These are often high in sugar and fat;</p> <p>Crisps, chocolate, biscuits, pasties, sausage rolls</p>  <p>These will raise your blood sugar levels</p>	<p>Food and drink with large amounts of sugar / added sugar including;</p> <p>Sugar, honey, sugary drinks, sweets, ordinary fizzy pop, fruit juices</p>  <p>These usually raise your blood sugar levels quickly</p>

**High sugar levels**

Vegetables	Fats & Spreads
<p>(potatoes) whether fresh,</p> 	<ul style="list-style-type: none"> <li>• Any cheese spread</li> <li>• Meat paste / pate</li> <li>• Butter</li> <li>• Margarines</li> <li>• Oils</li> </ul> 

**Highly require insulin**

## Quick acting (QA)/Bolus Insulin

Examples include:

Actrapid and Humulin S = soluble insulin

Humalog, Novorapid Apidra and Fiasp = analogue insulin

**Analogue insulin** acts very quickly – within 15 minutes of injecting it will start to lower your blood glucose levels. It reaches its peak of action between 50–90 minutes and can continue to affect your blood glucose for 2–5 hours after injecting. Fiasp is a faster acting analogue insulin and will be effective much quicker (within five minutes) but for a shorter length of time.

**Soluble insulin** acts slightly slower than the analogue insulin – within 30 minutes of injecting this type of insulin will start to lower your blood glucose levels. It reaches its peak of action between 2–4 hours and can continue to affect your blood glucose for up to eight hours after injecting. Analogue insulin is more commonly used, however if you are using soluble insulin and it is suiting you there is no need to change.

## Background/Basal insulin (BI)

Examples include: Insulatard, Humulin I = isophane insulin

Lantus, Levemir, Abasaglar, Semglee, Toujeo and Tresiba = long acting analogue insulin. Background insulin works more slowly than quick acting insulin, doses are usually taken more than eight hours apart e.g. on waking and before bed to prevent overlapping of insulin.

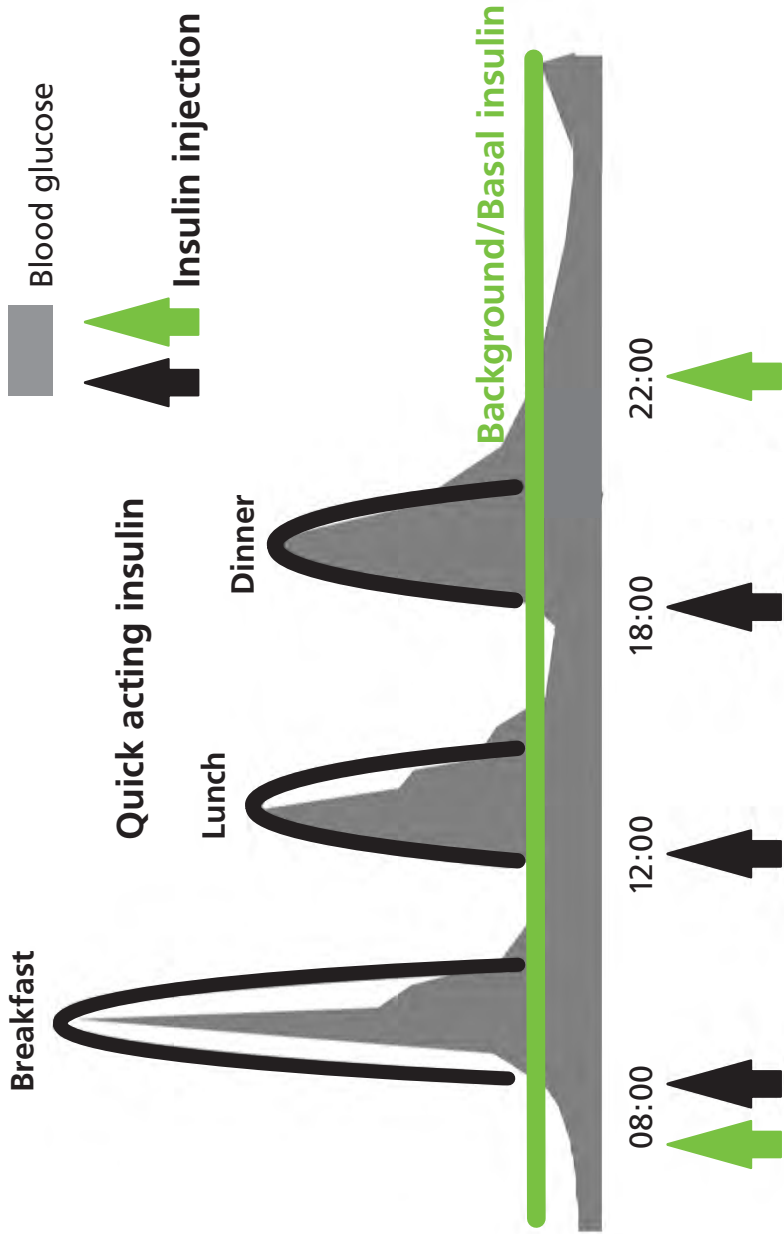
**Isophane insulin** looks cloudy and needs to be mixed well before injecting. It is usually given twice daily; first thing in the morning and in the evening - within two hours of injecting it will start to lower your blood glucose levels. It reaches its peak of action between 4–6 hours and can continue to affect your blood glucose for 8–14 hours after injecting.

**Long acting analogue insulin** works for longer than the isophane insulin, it is clear and therefore does not need to be mixed before injecting. It is usually given once or twice daily. This type of insulin has a much longer duration of action, between 18–24 hours and has a much less defined peak of action. Tresiba is an ultra-long acting analogue insulin and therefore is only required once daily.



# Basal (Background)/Bolus

# (Quick Acting) Regime



## Hyperglycaemia / high blood glucose levels

It is usual for blood glucose levels to be raised at times such as following meals and during periods of stress /illness. If your blood glucose levels are higher than you expected, reflect on what may have caused this before correcting this with quick acting insulin.

- Have you eaten more CHO than you gave insulin for?
- Have you eaten a snack since you last gave insulin?
- Are you feeling unwell?

Then consider correcting this with additional quick acting insulin.

### Remember...

- **1 unit QA insulin will lower** blood glucose levels by 2–3mmol/L
- See cover for your insulin sensitivity

## Hypoglycaemia / low blood glucose levels

Whether you have symptoms or not, any blood glucose level of less than 4mmol/l is too low and should be treated immediately.

Mild hypos are not unusual – experiencing one or two per week may be normal for people aiming for optimal control. If your blood glucose levels are lower than you expected, reflect on what could have caused this:

- Have you eaten less CHO than you gave insulin for?
- Have you been more active than expected?
- Have you drunk alcohol in the past 24–48 hours?

Following a hypo, expect your blood glucose levels to be higher than target the next time you check.

### Remember...

- **10g carbohydrate will raise** blood glucose levels by 2–3mmol/L
- NEVER correct a high blood glucose level following a 'hypo'

## Snacking

Depending on which insulin you have taken before, you may have been advised to eat snacks between meals to maintain your blood glucose levels. On a basal bolus regimen, snacking between meals is no longer essential but up to you as an individual. Although it is your choice to snack, be aware that snacking means additional energy which can lead to weight gain.

Snacks containing more than 10g CHO will require additional insulin.

Until your insulin to carbohydrate ratios (ICR) are established, you may be advised to avoid snacking on carbohydrate between meals.

If this is not possible, start by giving one unit QA insulin to 10g carbohydrate with snacks. When ratios are established, take QA insulin at the time you snack using your usual ICR.

### Remember...

If you have a snack requiring insulin less than four hours before a meal, do not correct the pre-meal BG if it is above target.

## Alcohol

Everyone responds differently to alcohol – the only way to find out your response is to check your blood glucose levels before and after. Please follow any specific advice provided by your Diabetes Team.

Alcohol can cause delayed hypos and together with increased activity the risk of hypos is much greater.

Unless advised by your doctor, there is no reason to completely avoid alcohol because of your diabetes. Alcoholic drinks do contain varying amounts of alcohol and carbohydrate so will affect your weight and may also affect your blood glucose levels.

There are no 'safe' limits; it is recommended that you keep your alcohol intake to less than 14 units per week and that this should be spread over the week.

Alcohol intake can result in delayed hypos, together with increased activity the risk of hypos is much greater. To minimise the risk of hypos:

- limit your alcohol intake to less than three units in one sitting
- drink with meals containing carbohydrate, not on an empty stomach
- include a small carbohydrate snack e.g. slice of toast/glass of milk before bed if drinking in the evening

The following page has a guide as to how you can help control your blood glucose levels when consuming alcohol.

### Remember...

There are no 'safe' limits, it is recommended that you keep your alcohol intake to less than 14 units per week

\* allowing 2 alcohol free days per week

\* 1 unit = ½ pint beer/lager

1 small glass wine

1 pub measure (25ml) of spirit

Drink	CHO	Suggested action
Wines (red, white, sparkling, Champagne)	–	Less than 2 units of alcohol should not require any action More than 2 units of alcohol increases the risk of hypos, consider;
Spirits (vodka, gin, rum, brandy)	–	<ul style="list-style-type: none"> <li>reducing your evening dose of background insulin by 20% and/or</li> </ul>
Sweet wines (dessert wine, sweet Martini, sherry)	5g per glass	<ul style="list-style-type: none"> <li>include a small carbohydrate snack (10-20g) without QA insulin</li> </ul> No additional QA needed
Standard beer, lager, cider	10g per pint	The CHO in these can cause a temporary rise in blood glucose levels before the risk of delayed hypo Less than 15g CHO (approx. 1pint) should not require any action More than 15g CHO may require additional QA insulin, consider;
Strong beer, lager	15g per pint	
Sweet cider and Alcopops	20g per pint/ bottle	
Liquers (Baileys, Tia Maria, port, Cointreau)	5g per measure	
Low alcohol drinks (Kaliber, Swan light)	10g per bottle	These alcohol-free drinks will not increase your risk of hypo so should be considered like other sugary drinks

## Physical activity

Keeping physically active is important for everyone, not just for those with diabetes, as it improves/maintains your general health.

If you are not usually active or have any other health conditions, please discuss this with your consultant/GP before starting.

If you are currently not able to manage 30 minutes of exercise in one go, start slowly and gradually increase your activity. Activity can take many forms and does not just apply to sport, for example:

- House work
- Dancing
- Painting and decorating
- Walking and hiking
- Dancing
- Sex

Aim to be active for at least 30 minutes every day – by being more active, less energy needs to be stored in the body as fat which may:

- Improve response to insulin
- Reduce stress levels
- Help control weight
- Improve heart health
- Improve how you look/feel

Generally, during activity the body uses blood glucose as an energy source, which may lower blood glucose levels. During times of increased activity, the body can use blood glucose more quickly. Therefore you should always consider:

- Carrying rapid acting carbohydrate
- Monitoring blood glucose levels before, during and after activity
- When you last injected insulin

## When NOT to proceed with physical activity

There are times when you should NOT be physically active/exercise.

Low Blood Glucose	
Severe Hypoglycaemia - hypo requiring 3rd party assistance	DO NOT EXERCISE FOR 24 HOURS
Self-treated Hypoglycaemia	Be careful for next 24 hours  <b>Before exercise;</b> treat & aim for stable BG for at least 60 minutes before starting  <b>During exercise;</b> stop, treat & aim for stable BG for at least 45 minutes before restarting
High Blood Glucose	
Ketones above 1.5mmol/L	DO NOT EXERCISE  Correct with QA insulin  Drink sugar-free fluids  Wait until ketones dropping before exercising
Ketones below 1.5mmol/L	Low/Moderate intensity exercise only  <b>Eaten and/or given QA insulin within previous 2hrs;</b> monitor  <b>Not eaten and/or not given QA insulin injection within previous 2hrs;</b> correct cautiously with QA insulin

## Guide to adjusting for physical activity

All activity/exercise will affect blood glucose (BG) levels – it may not be easy, but the good news is that with the right guidance and support you can learn to safely manage your BG levels around your chosen activity.

For people with diabetes treated with insulin, the risk of hypoglycaemia is increased both during and in the hours following activity. The risk of hypoglycaemia can be reduced by:

- Increasing the amount of carbohydrate consumed and/or
- Reducing the amount of insulin injected

Planning your activity will allow you to choose how to manage your diabetes whereas unplanned activity will limit your options. The following is a starting guide to help control blood glucose levels and optimise control around activity.

If you are planning to start exercising regularly or are working towards a sporting event please speak to the Diabetes Team about how to manage your BG levels before, during and after exercise.



## Planned activity

Activity planned/completed	Suggested Action
Within 120 mins/2 hours of a meal requiring QA insulin	Reduce total QA insulin dose by 50%
More than 120 mins/2 hours after a meal requiring QA insulin	Take normal amount of QA insulin Refer to BG before starting exercise table
Before meal requiring QA insulin	Reduce total QA insulin dose by 50%
After 4pm OR lasted more than 2 hours OR done at high intensity OR which is new to you	Reduce evening dose of BI by 20%

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## Unplanned activity

<b>BG before starting activity</b>	<b>Suggested Action</b>
Less than 4mmol/L	Hypo – take 20g fast acting carbohydrate & retest in 10 minutes
4.0 – 5.6mmol/L	Take 20g carbohydrate & retest
5.7 – 6.9mmol/L	Take 15g carbohydrate & proceed with activity
7-15mmol/L	Proceed with activity
BG greater than 15mmol/L	If you have T1DM, check blood ketone levels
Ketones less than 0.6mmol/L	Proceed with activity
Ketones 0.7 - 1.5mmol/L	Correct with QA insulin – 30% of usual correction dose
Ketones above 1.5mmol/L	Correct with QA insulin – DO NOT proceed with activity

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## For further information/advice contact

Diabetes Specialist Dietitian:

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Diabetes Specialist Nurse:

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The Trust provides free monthly health talks on a variety of medical conditions and treatments. For more information visit [www.uhb.nhs.uk/health-talks.htm](http://www.uhb.nhs.uk/health-talks.htm)

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