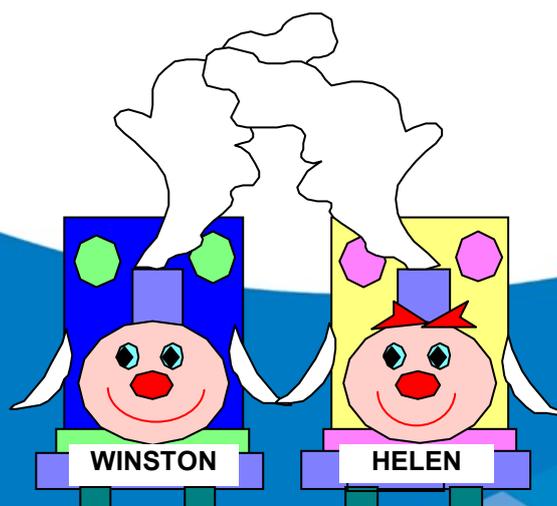


Advanced Bolus Options on an Insulin Pump

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Na żądanie ta ulotka może zostać udostępniona
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Introduction

If you are on an insulin pump then you have the option to use different types of insulin bolus.

This leaflet provides advice on how different insulin bolus types can be used for different foods or meals.

Information included in this information leaflet:

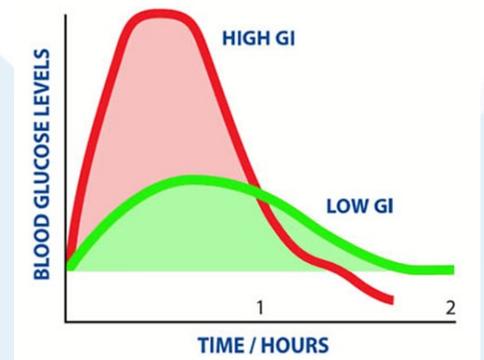
- Glycaemic Index (GI) overview
- What is a normal '**Standard**' Bolus?
- What are **Dual and Square Wave Boluses** (Medtronic pumps) or **Extended Boluses** (Omnipod or T: Slim pumps)?
- When to use Dual, Square and Extended boluses?
- How to test and adjust Dual Wave/Extended Boluses.

Glycaemic Index

The glycaemic index (GI) is a scale (from 1-100) of how quickly individual carbohydrate containing foods raise blood glucose levels.

Pure glucose is used as a reference and is given a value of 100 as it very rapidly raises blood glucose levels.

- **High GI** foods are given a value greater than 70 and raise blood glucose levels quickly.
- **Low GI** foods are given a value of less than 55 and these give a slower rise in blood glucose levels that lasts for longer.



GI only tells you how quickly or slowly a food raises your blood glucose if it is eaten on its own.

Usually, foods will be eaten in combination with other foods, for example if you eat egg on toast the protein and fat in the egg will affect the GI of the toast, making it slower release (lower GI).

Opting for lower GI carbohydrates at meal times can help to reduce post-meal spikes in blood glucose levels.

The main effect on blood glucose levels is the total amount of carbohydrate eaten which is why carbohydrates are counted and insulin is given for that amount of carbohydrate.

Ask your dietitian for more information on GI and how much carbohydrate is right for you.

The following factors affect the GI value of a food:

1. Fibre in foods

Fibre in foods such as wholegrains, vegetables, pulses and fruit slows down carbohydrate digestion and lowers the GI value.



2. Type of Starch

Pasta has a low GI because of the unique chemical starch structure.



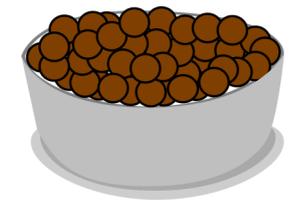
3. Fat and Protein

Foods with more fat and/or protein have a lower GI as they slow down digestion which delays the rise in blood glucose level, tending to cause a delayed rise.



4. Processing of food

Generally, the less processed a food is, the lower the GI. For example rolled or steel cut oats have a lower GI than instant oats.



5. Cooking of food

Cooking method may affect GI. Boiling will break down starch and increase GI. Pasta boiled to an 'al dente' texture will have a lower GI than well-cooked pasta.

6. Ripeness of food

Less ripe fruit has a lower GI than very ripe fruit.



7. Individual Variation

Everybody is unique and different people tend to respond to foods differently therefore it is important to work out what works for you.

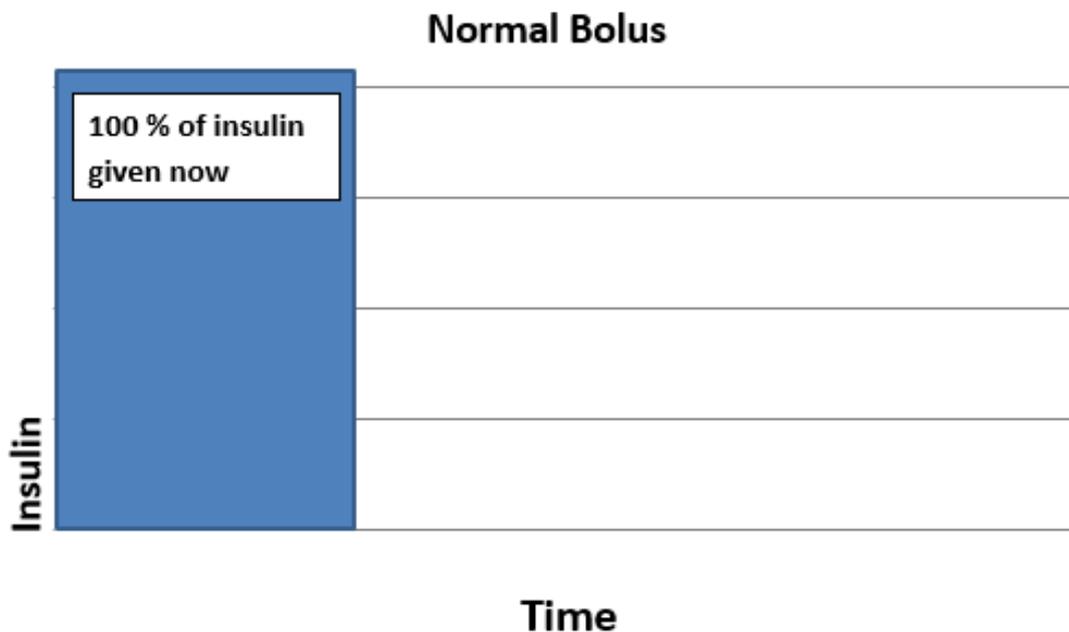
Table of the GI of foods

	Low GI (less than 55)	Medium GI (55-70)	High GI (over 70)
Breakfast cereals	All bran muesli, porridge	Some muesli, instant porridge, shredded wheat, weetabix	Coco pops, cornflakes, rice crispies, cheerios
Bread	Rye bread, soy & linseed bread, multigrain bread, pumpernickel bread, some sourdoughs	Wholemeal bread, malt loaf, pitta bread, sourdough	White bread, baguette, bagel
Potatoes and grains	Pasta, soba noodles, basmati rice, quinoa, bulgur wheat	Sweet potato, new potato, brown rice, rice noodles, cous cous	Mashed potatoes, baked potatoes, french fries, instant mashed potato, white easy cook rice
Beans/Pulses	Baked beans, blackeye beans, chickpeas, butter beans, kidney beans, lentils		Broad beans
Fruits	Apple, apricot, banana, orange, peach, pear, cherries, berries, nectarine, strawberries, grapes	Mango, pineapple, raisins/sultanas, melon, papaya	Watermelon
Vegetables	Carrots, peas	Sweetcorn	Pumpkin, parsnip
Dairy & alternatives	Milk, soy milk, fromage frais, crème fraiche, yoghurt, probiotic drinks	Some sweetened yoghurts, oat milk	Rice milk
Confectionary	Chocolate, jam	Ice cream, crisps	Pancakes, sweets

Different Types of Insulin Bolus

Normal/ 'Standard' Bolus

When you use an insulin pump to deliver a 'normal' /'standard' bolus, all of the insulin bolus is delivered within a few minutes.

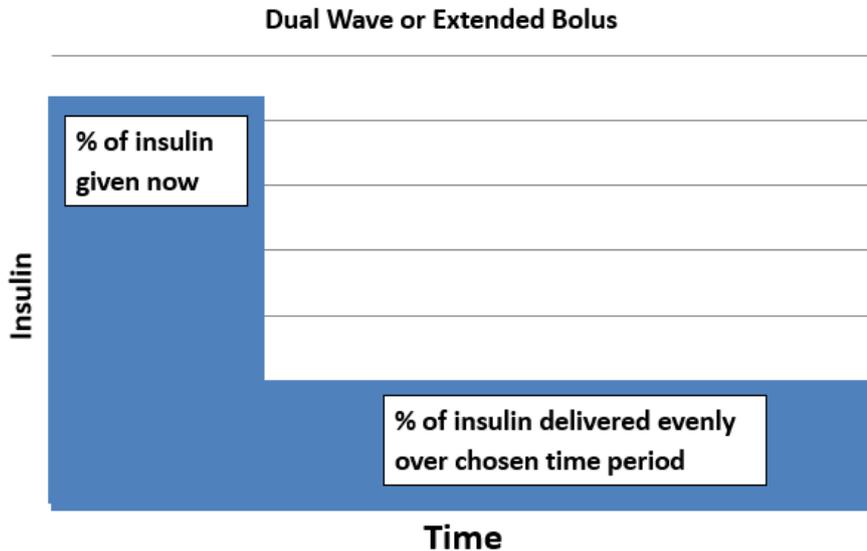


What type of foods should you require a normal/ 'standard' bolus?

- A normal bolus works best delivered pre-meal, 15-20 minutes before meal/snack with rapid-acting insulin (such as Novorapid, Apidra, Humalog). Or 5 minutes or just before a meal/snack with Fiasp.
- This works well for most meals and snacks however different carbohydrate-containing foods/meals can affect blood glucose levels in different ways.
- Rapid acting insulin (Novorapid, Apidra or Humalog) in your pump starts working within about 15 minutes and it works most strongly at around 90 minutes. However, Insulin Fiasp starts working within a few minutes of being given.

Dual Wave/Extended Boluses for Low GI Meals

- A Dual Wave or Extended bolus splits the insulin dose into two parts: insulin that is given straight away, as a normal bolus, and insulin that is spread out and delivered evenly over a time period that you choose.



- You can choose how much of the bolus to deliver now and how much to deliver evenly over your chosen time period.
- Due to the slow release nature of the foods you use a Dual Wave or Extended Bolus with, delivering the bolus over 2-2.5 hours is usually recommended as a starting point.

For instructions on how to deliver a Dual Wave bolus on a Medtronic pump or an Extended bolus on an Omnipod or T: Slim Pump, please ask your diabetes team.

What type of foods should you use a Dual Wave/Extended Bolus With?

- A Dual Wave/Extended Bolus works best for meals that are digested slowly (low GI) and where meals are high in fat and/or protein (see examples on the next page).
- When meals are eaten that are digested very slowly (low GI), the insulin action of a 'normal bolus' may not best match digestion. A Dual Wave/Extended Bolus will be a better match.
- A 'normal bolus' with low GI meals may reduce your blood glucose initially (within 90 minutes). This is because the insulin is working faster than the carbohydrate is being digested. However as you continue to digest your meal, and as your active insulin reduces, your blood glucose level may become high as the carbohydrate continues to be digested and absorbed from the meal.

What type of foods should you use a Dual Wave/Extended Bolus With?

Meals that may benefit from using a Dual Wave/Extended bolus with include:

- Pasta
- Very high fibre, low GI meals based on lentils/pulses (e.g. dahls or lentil salads/stews)
- Large carbohydrate meals
- Meals high in fat and protein*
- Pizza*
- Roast dinner*
- Fast food (e.g. Burger & Fries) *
- Takeaways such as Chinese, fish and chips, kebabs and Indian*.



***Note:** Additional insulin for the high fat/protein content may be required if you experience a large post-meal rise in blood glucose (often seen 3+ hours after the meal) despite using a Dual Wave or Extended bolus. See information leaflet on managing high fat/protein meals and speak to your dietitian for individual advice.

! Remember, it is important to eat a healthy, balanced diet. Eating highly processed foods high in fat on a regular basis can cause unhealthy weight gain and lead to higher risk of complications such as heart disease.

What split should I use?

- Whatever split and duration you decide, a Dual Wave/Extended Bolus will usually better match the digestion of low GI meals than a normal bolus. The important thing is that you monitor blood glucose levels, make notes and adjust accordingly.
- **For high fat and protein meals** (such as takeaway foods) at least 60% has been found to work best for the first part of the bolus (60:40 split).
- However, this is very individual therefore it may be beneficial to work with your dietitian to get best results. You can also see the information sheet on managing high fat/protein meals.

The aim is to keep blood glucose levels under 9mmol/l two hours after meals.

How to test and adjust a Dual Wave/Extended Bolus

As everybody is different, it is important that the split and duration of the Dual Wave/Extended Bolus is adjusted for each individual based on blood glucose levels. Your diabetes team can help with this.

To test whether a Dual Wave/Extended Bolus has been effective you will require blood glucose testing or, if you are using continuous glucose monitoring (CGM) or Libre, you can use these for testing at the following times:

- **Before** eating meal
- **At 2 hours after** the meal and
- **Between 3-5 hours after** the meal
- **The first test at 2 hours** allows you to test whether the initial part of the insulin bolus delivered was right (i.e. prevented an initial post-meal rise or dip in blood glucose level) as this is when the insulin in the initial part of the bolus is peaking
- **The test at 3-5 hours** can help guide the duration of the bolus and whether additional insulin may be required for fat and protein (see information sheet on fat and protein).

! Before testing dual waves it is important to be confident that your insulin to carbohydrate ratios are correct.

If you are often high after a particular meal time (2 hours after), regardless of GI or fat and protein content of the meal, then it is likely that your insulin to carbohydrate ratio needs adjusting for that time of day – speak to your diabetes team if you are unsure.

Example of how to test and adjust a Dual Wave/Extended Bolus

For example, for the meals below a 50:50 split was given as a Dual Wave/Extended Bolus over 2 hours.

Scenario	Blood Glucose Level Pre-Meal	Blood Glucose Level 2 Hours Post-Meal
E.g. Meal 1	6.5	12.1
E.g. Meal 2	6.5	3.2

E.g. Meal 1

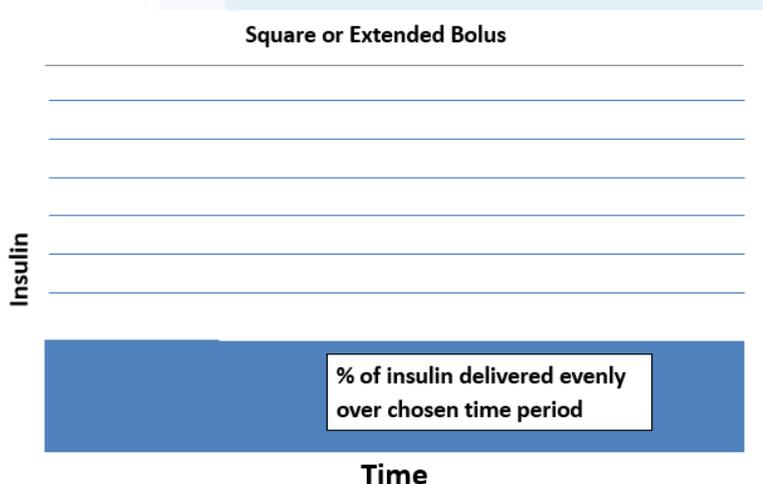
- Blood glucose has risen significantly above pre-meal blood glucose level (greater than 2-3mmol/l rise) and is also above the target range for after meals (5-9mmol/l). Therefore a larger amount of insulin is needed in the first part of the insulin bolus to control the post-meal rise. You could try 60:40 or 70:30 split next time instead of a 50:50.

E.g. Meal 2

- Blood glucose has dropped below target range to within the hypoglycaemic range, therefore a lesser amount of insulin is needed in first part of the insulin bolus. You could try a 40:60 or 30:70 split next time instead of a 50:50.

Square Wave Bolus

A 'Square Wave' Bolus is a bolus where no insulin is delivered up front (0%) and the entire bolus (100%) is spread evenly over a time period that you choose.



- Dual waves/Extended boluses usually work better to prevent spikes after meals.

If you have any further questions please contact your diabetes team.

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