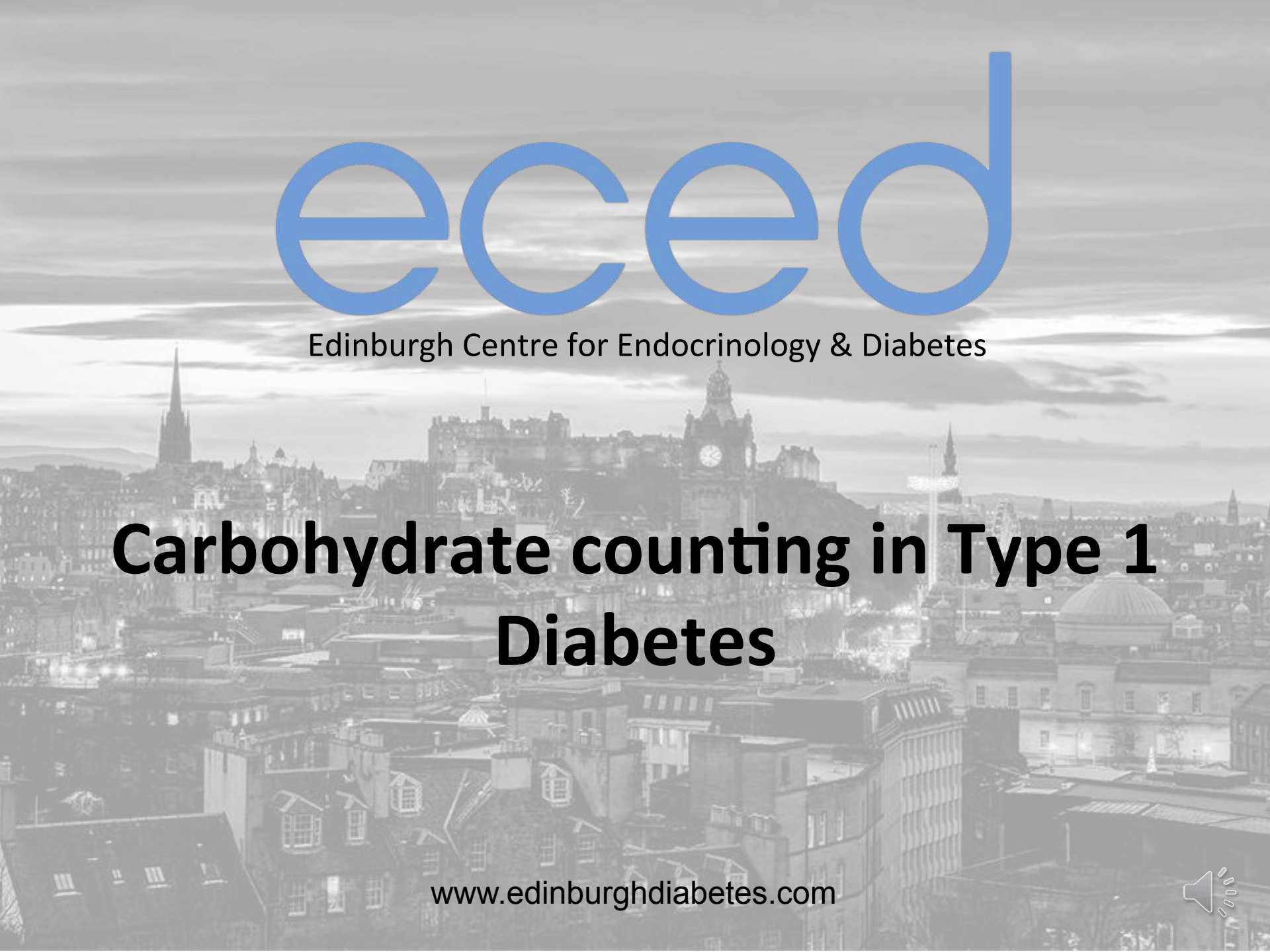
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Carbohydrate counting in Type 1 Diabetes
www.edinburghdiabetes.com

Disclaimer

This presentation is intended as a general guide. It is important to recognise there are significant differences between individuals. It is important to carefully assess the effects of any changes in insulin therapy through frequent blood glucose monitoring. Where you are uncertain, you should contact your specialist diabetes team for further advice.

All people with type 1 diabetes, attending ECED diabetes clinics, are strongly encouraged to attend a DAFNE course. There is very good evidence that attending DAFNE improves diabetes control, reduces hypoglycaemia and improves quality of life. Contact your specialist team for further information.

Introduction

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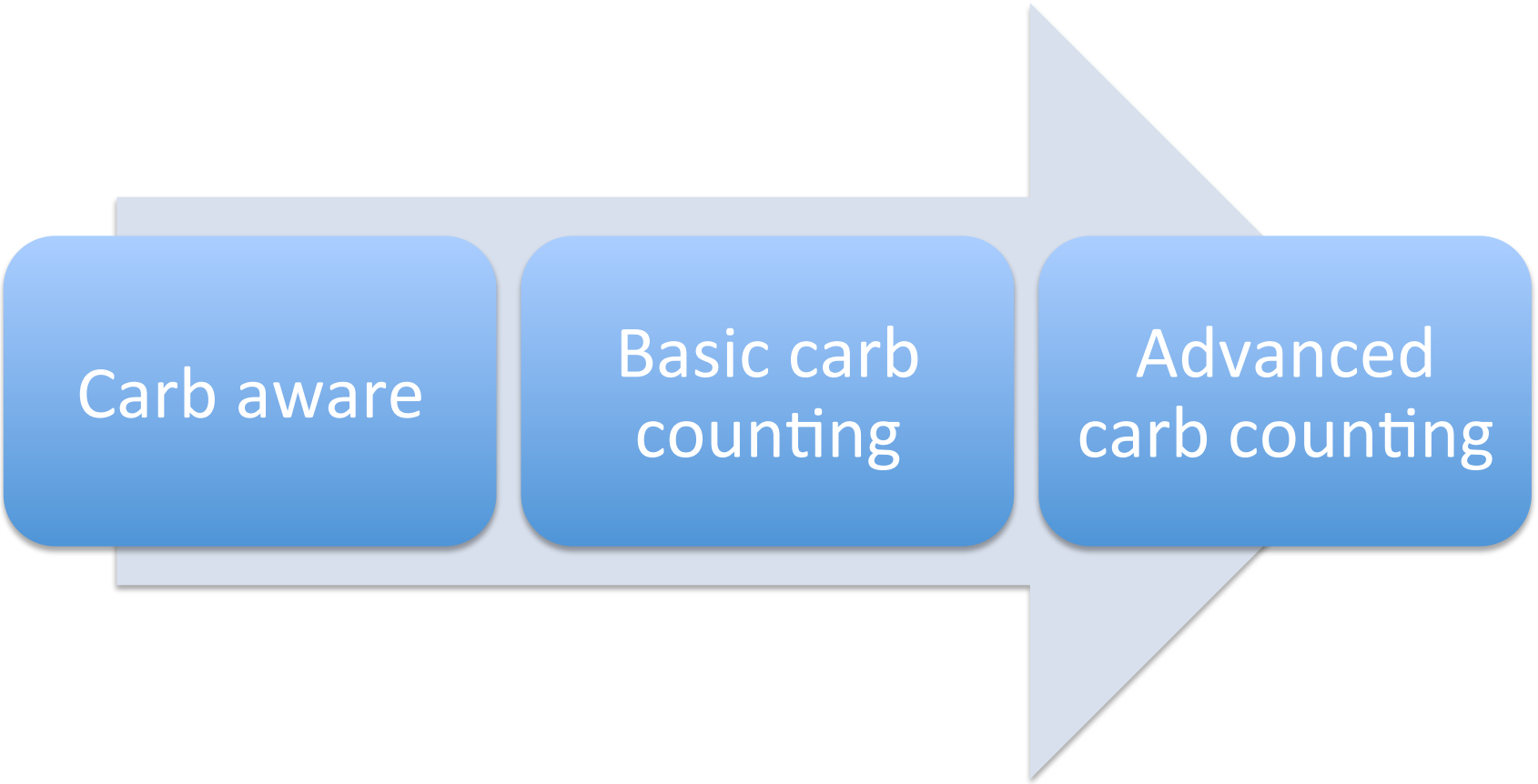
Carb counting

Learning by experience



All patients with T1 diabetes should have access to a structured education programme – in Edinburgh we offer DAFNE courses

Carb counting

The more glucose information – the better

Number of blood glucose tests per day	Average HbA1c % (old units)	Average HbA1c mmol/mol (new units)
0 to 2	8.6	71
3 to 4	8.0	64
5 to 6	7.6	60
7 to 9	7.4	57

Regular blood glucose monitoring is associated with greater control of diabetes – particularly when combined with carbohydrate counting.

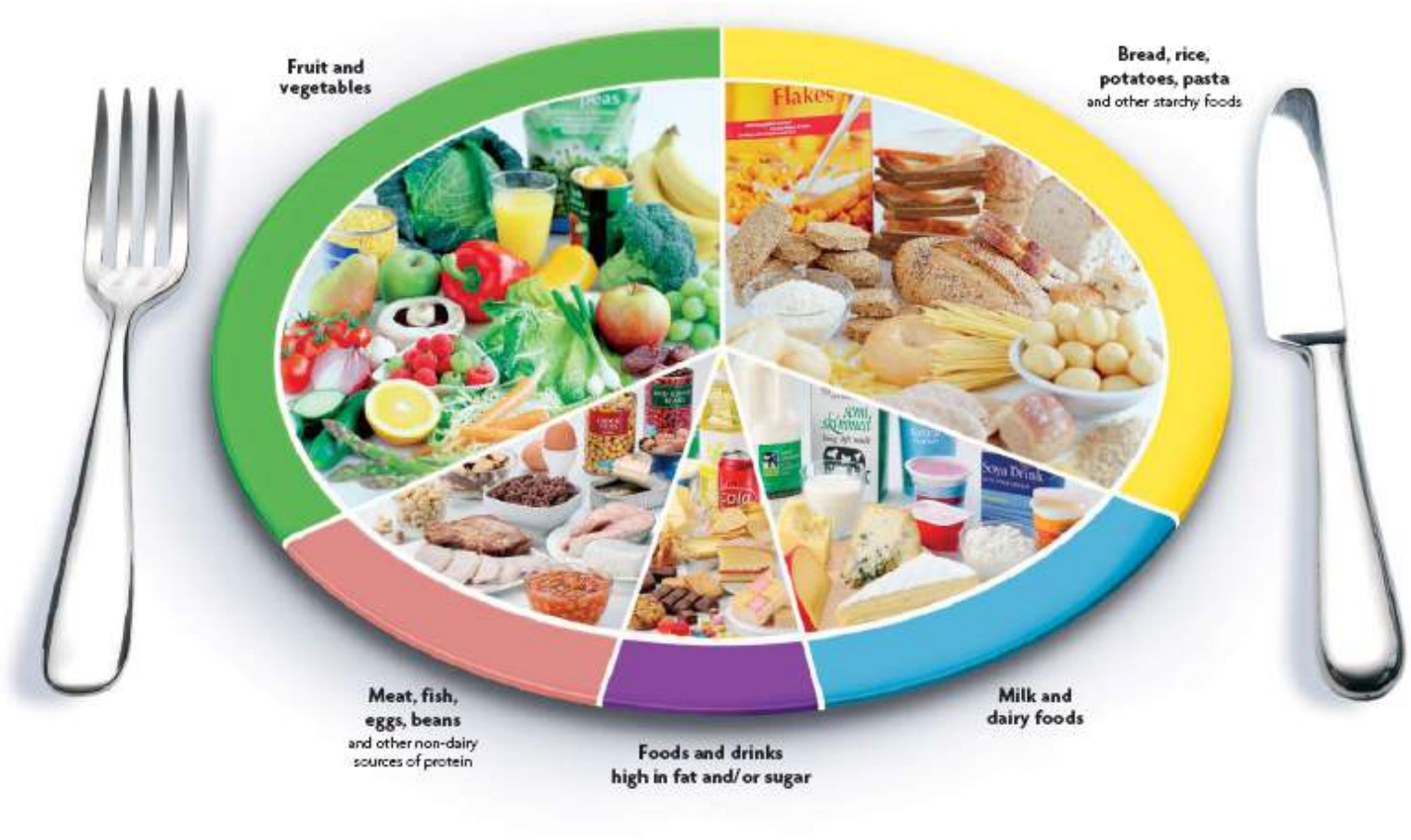
Healthy eating advice

The same for people who don't have diabetes

- Plenty of starchy foods such as rice, bread, pasta and potatoes (choosing wholegrain varieties when possible)
- Plenty of fruit and vegetables; at least 5 portions of a variety of fruit and vegetables a day
- Some protein-rich foods such as meat, fish, eggs, beans and non dairy sources of protein, such as nuts and pulses
- Some milk and dairy, choosing reduced fat versions or eating smaller amounts of full fat versions or eating them less often
- Just a little saturated fat, salt and sugar

Healthy eating

Carbohydrates are not ‘unhealthy’



Healthy eating

Portion control – we eat more than we need

20 years ago
85 calories

Today
250 calories

20 years ago
500 calories

Today
850 calories

The basics

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Food types

Carbohydrate, protein and fat

Protein	Fat	Carbohydrate
Meat	Butter	Bread
Nuts	Margarine	Rice
Fish	Oil	Pasta
Eggs	Cream	Breakfast cereals
Cheese	Mayonnaise	Milk
		Fruit
		Sugar

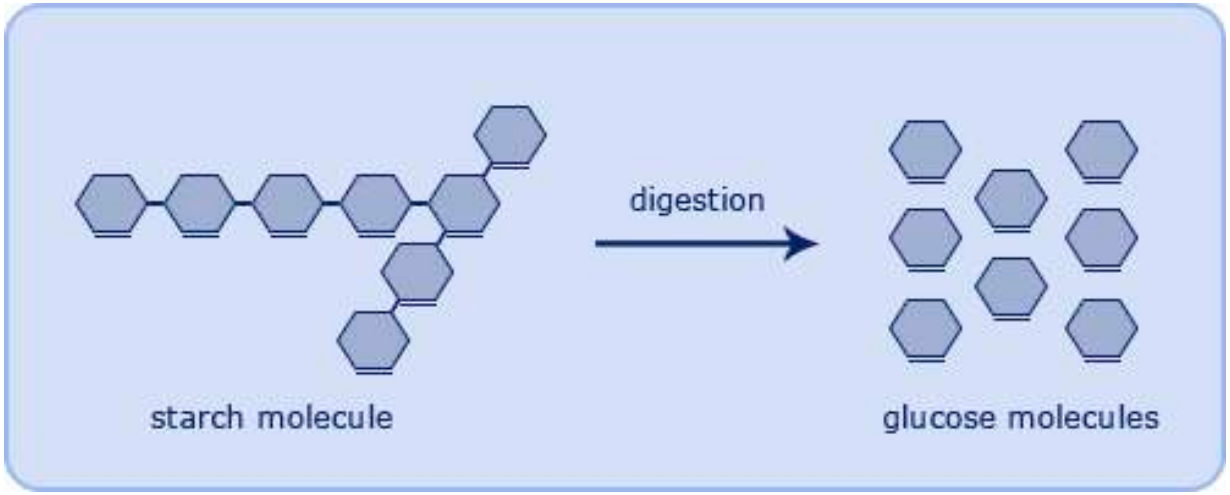
Carbohydrate

An essential component of a healthy diet

- Carbs are not ‘bad’ for you
- Carbohydrate is an essential component of a healthy diet
- Guidelines suggest around 230 grams for women and 300 grams for men
- Most carb intake should come from starchy carbohydrates, fruit and vegetables

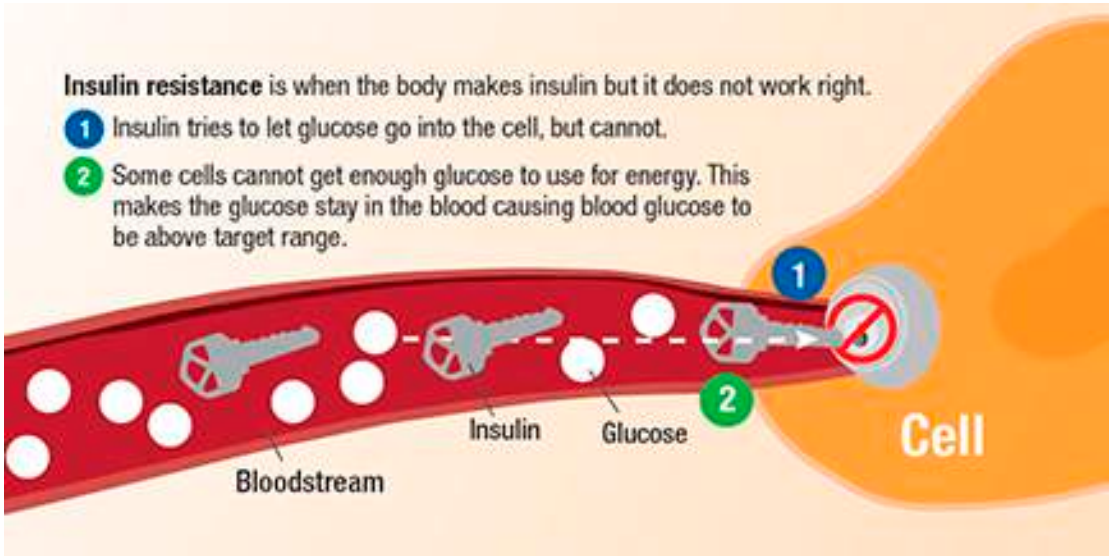
Carbohydrates

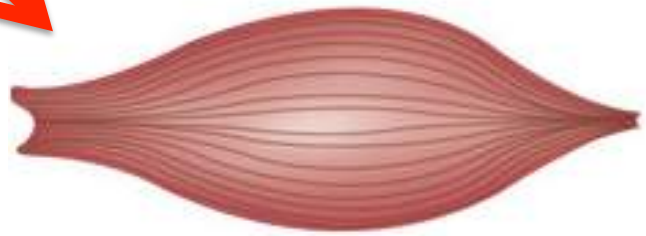
Not just sugar



Insulin and glucose

What does insulin do?





Why fixed insulin doses don't work

Carbohydrate content is IMPORTANT

Almost 0g

50g

Why fixed insulin doses don't work

Carbohydrate content is IMPORTANT

160g

40g

Carbohydrate counting: first steps

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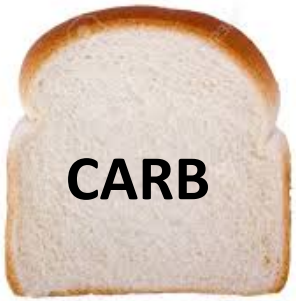
What foods contain carbs?

Low carb foods are higher in protein / fat



Carbohydrate counting

What is it

- Carb counting means matching the amount of insulin you give with the amount of carbohydrate in the food you eat

- It is a process which become much easier with practice

- It requires ‘trial and error’

Basic carb awareness

First steps

- What meals do you have frequently
- Breakfast and lunch are often quite similar
- Most people have a small repertoire of main evening meals

- Work out the carb content of these and start to assess the effects they have on your glucose levels

The carbohydrate portion

Matching carbs with insulin

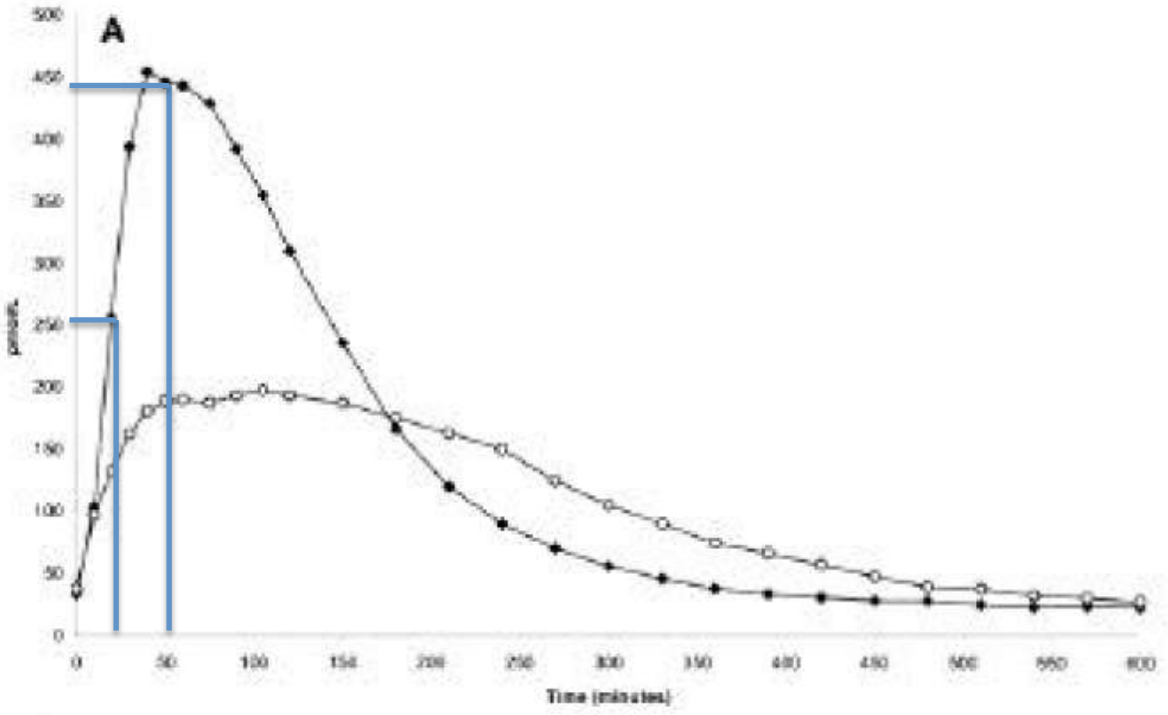
- 1 carbohydrate portion (CP) is the same as 10 grams of carbohydrate

- CP is the term used in DAFNE

- 1CP would typically raise blood glucose by 2 – 3 mmol/L

Insulin action

Why it matters – timing is important



IDEALLY 15 – 20 MINUTES **BEFORE** MEALS

Glycaemic index

Different for different type of carbohydrate

- GI is a measure of how quickly carbohydrate causes the blood glucose level to rise
- High GI foods (e.g. cola, fruit juice etc.) cause the glucose to rise quickly
- Low GI foods (e.g. beans, nuts etc.) cause slower, less pronounced rises in glucose

High GI

Low GI

Glycaemic index

Effect on carb counting

- Some low GI foods have a minimal impact on glucose levels and may require no insulin or significantly less than anticipated based on their carbohydrate content


Cherries


Barley


Nuts


Beans


Grapefruit


Lentils

Glycaemic index

Effect on carb counting

- The DAFNE carbohydrate portion list gives advice on the carbohydrate in food which requires insulin cover

Hidden carbs

Things to watch out for

- Breadcrumbs on chicken and fish
- Cornstarch in soups
- Pasta sauces
- Barbecue sauce
- Croutons
- Large amounts of salad dressing
- Pie crust
- Beer / wine
- **Snacks!** (Ten grams free – avoid excessive snacking)

Glucose targets

In type 1 diabetes

- Discuss with your diabetes team
- Typically:
  - 5 to 7 mmol/L before breakfast
  - 4 to 7 mmol/L before other meals
  - 5 to 9 mmol/L 2 hours after meals
  - Pre-bed target (depends on timing of last meal) – typically between 6 and 8 mmol/L

Glucose targets

How to achieve them

- Experience with carb counting
- Glucose testing at least 5 times per day – ideally more than this (or CGM)
- Use correction factor
- Recognise patterns and adjust

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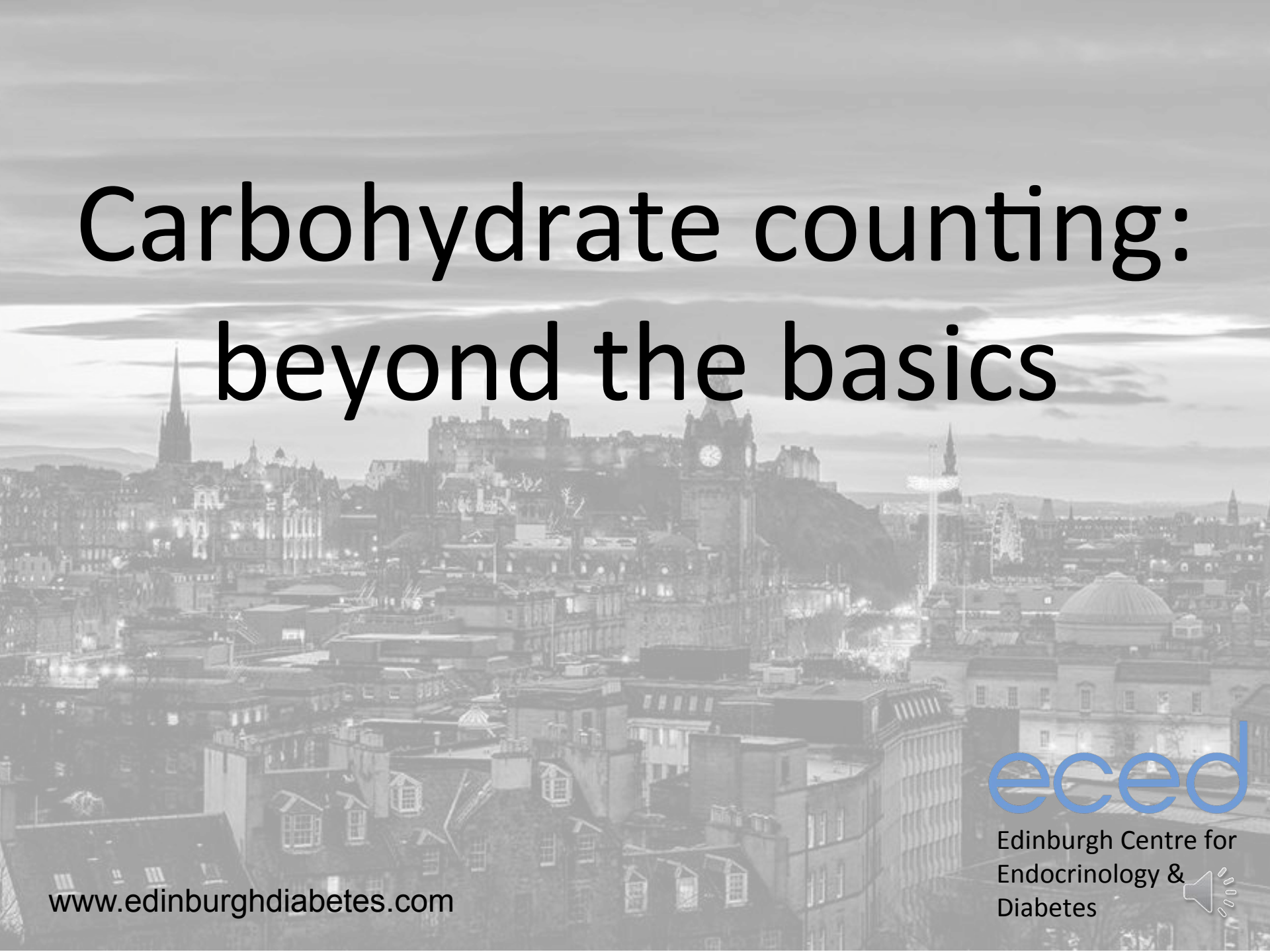
DAFNE

Glucose targets

Why are they important

- People feel better
- Much lower risk of diabetes complications
- Much lower risk of cardiovascular disease

Carbohydrate counting: beyond the basics



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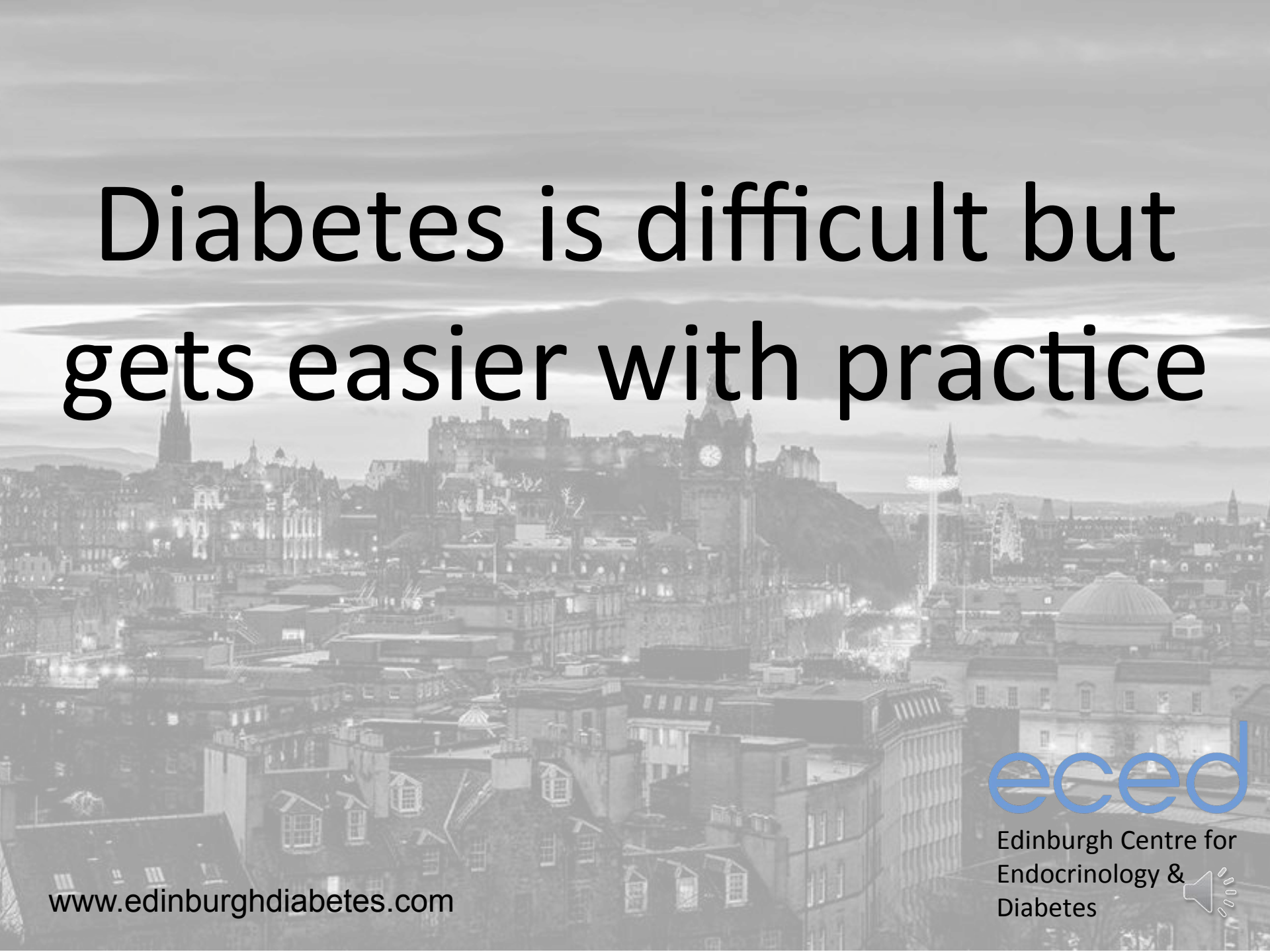
Diabetes is difficult but gets easier with practice



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Carbohydrate in food

- Accuracy of carb counting
- Glycaemic index

Fat and protein in food

- Effect on stomach emptying (slows)
- Effect on glucose disposal to muscle (reduces)

Counter-regulatory hormones

- Higher after hypos
- Higher with stress and illness
- Dawn phenomenon

Menstrual cycle

- Affects glucose in some women

Insulin factors

- Injections sites (giving set – pump)
- Variability of insulin (twice daily background better)
- Legs (slower) vs. Abdomen (faster)
- Timing of bolus
- Duration of bolus (pump)
- Needle length

Exercise / activity

- Different for anaerobic / aerobic exercise
- Duration of exercise

Alcohol

- Carbs increase glucose but later alcohol reduces liver glucose production

Stomach emptying

- Affected by high blood glucose
- Slowed by fat and protein in meals

Liver glucose production

- Reduced by insulin
- Increased by glucagon

Muscle glucose disposal

- Increased by insulin and exercise

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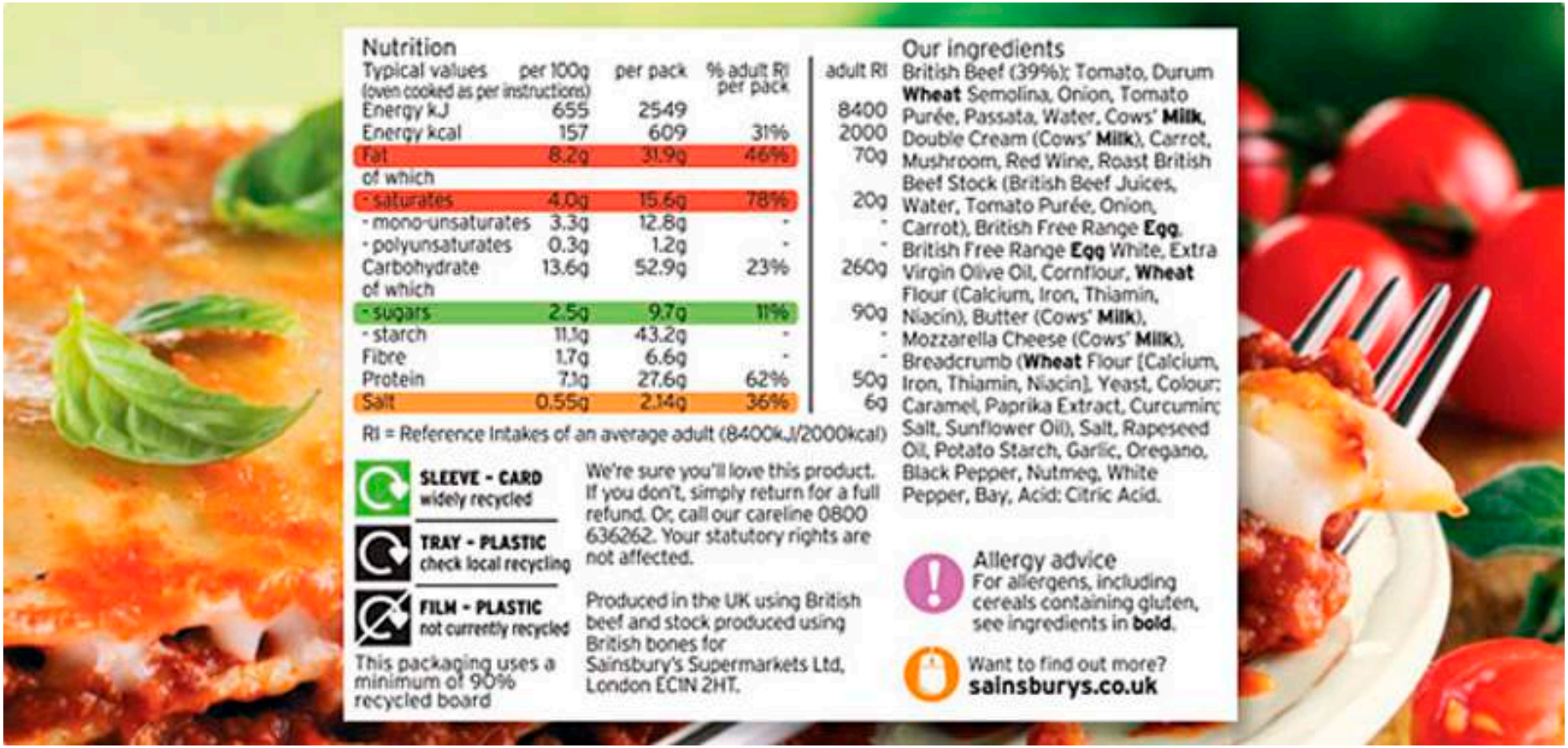
Getting carb information

Food labels



Nutrition

Typical values (oven cooked as per instructions)	per 100g	per pack	% adult RI per pack	adult RI
Energy kJ	655	2549		8400
Energy kcal	157	609	31%	2000
Fat	8.2g	31.9g	46%	70g
of which				
- saturates	4.0g	15.6g	78%	20g
- mono-unsaturates	3.3g	12.8g	-	-
- polyunsaturates	0.3g	1.2g	-	-
Carbohydrate	13.6g	52.9g	23%	260g
of which				
- sugars	2.5g	9.7g	11%	90g
- starch	11.3g	43.2g	-	-
Fibre	1.7g	6.6g	-	-
Protein	7.1g	27.6g	62%	50g
Salt	0.55g	2.14g	36%	6g

RI = Reference Intakes of an average adult (8400kJ/2000kcal)

Our ingredients

British Beef (39%); Tomato, Durum **Wheat** Semolina, Onion, Tomato Purée, Passata, Water, Cows' **Milk**, Double Cream (Cows' **Milk**), Carrot, Mushroom, Red Wine, Roast British Beef Stock (British Beef Juices, Water, Tomato Purée, Onion, Carrot), British Free Range **Egg**, British Free Range **Egg** White, Extra Virgin Olive Oil, Cornflour, **Wheat** Flour (Calcium, Iron, Thiamin, Niacin), Butter (Cows' **Milk**), Mozzarella Cheese (Cows' **Milk**), Breadcrumb (**Wheat** Flour [Calcium, Iron, Thiamin, Niacin], Yeast, Colour: Caramel, Paprika Extract, Curcumin; Salt, Sunflower Oil), Salt, Rapeseed Oil, Potato Starch, Garlic, Oregano, Black Pepper, Nutmeg, White Pepper, Bay, Acid: Citric Acid.

SLEEVE - CARD widely recycled

TRAY - PLASTIC check local recycling

FILM - PLASTIC not currently recycled

This packaging uses a minimum of 90% recycled board

We're sure you'll love this product. If you don't, simply return for a full refund. Or, call our careline 0800 636262. Your statutory rights are not affected.

Produced in the UK using British beef and stock produced using British bones for Sainsbury's Supermarkets Ltd, London EC1N 2HT.

Allergy advice
For allergens, including cereals containing gluten, see ingredients in **bold**.

Want to find out more?
sainsburys.co.uk

Getting carb information

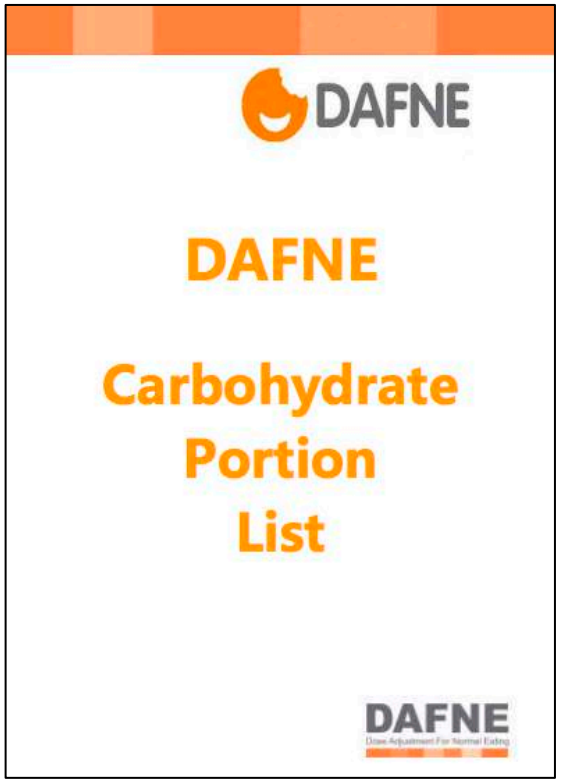
Weighing food

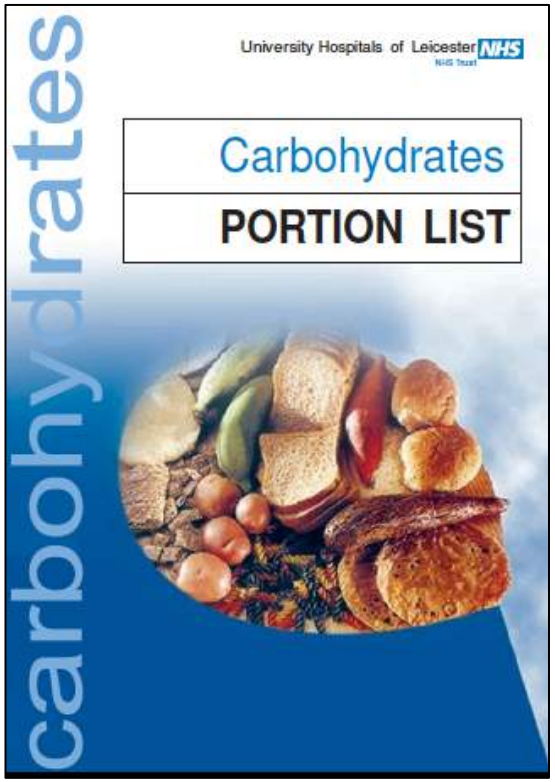
- Useful to get an idea of the weight of your typical portion of pasta / rice / cereal
- Jacket potatoes lose weight when cooked – weigh before

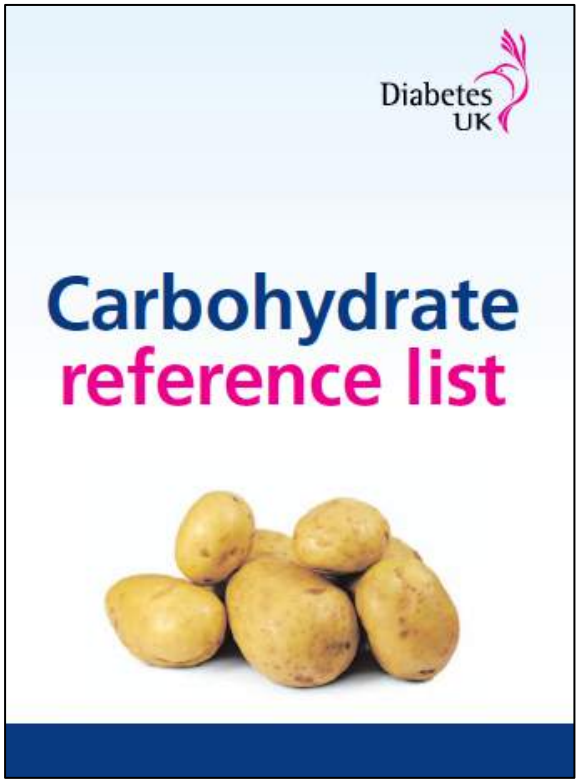
- Assess portions sizes using cup, mug etc. to give approximate weight

Getting carb information

Reference guides





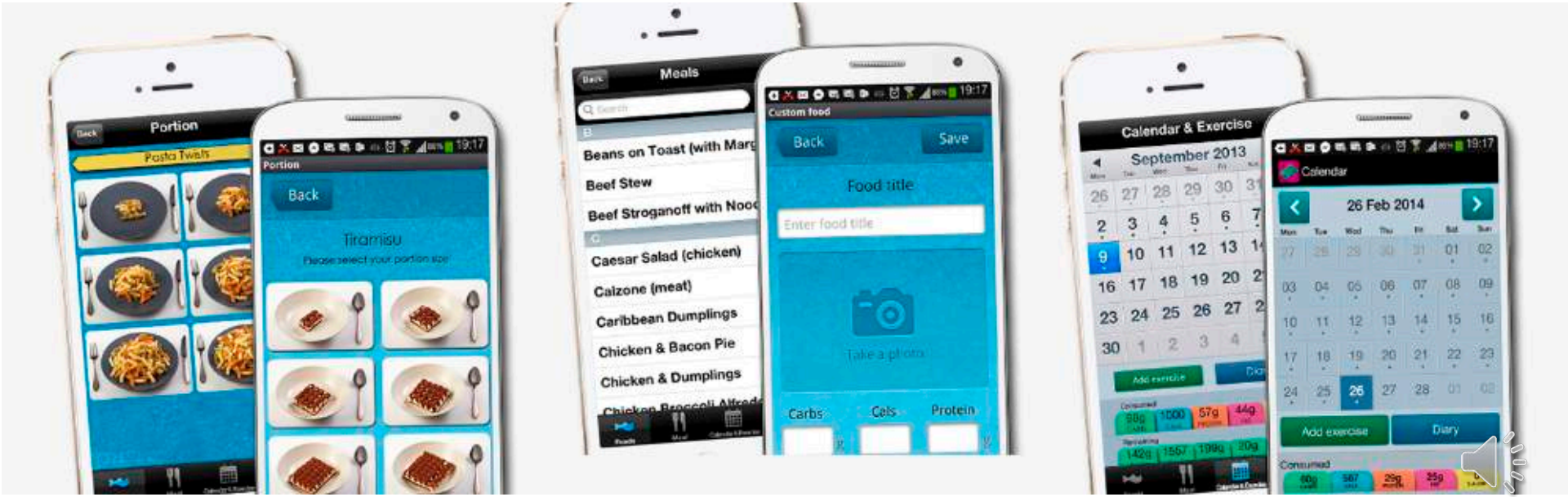


Google UK : Carbohydrate Portion List

‘Carbs and Cals’

App and book

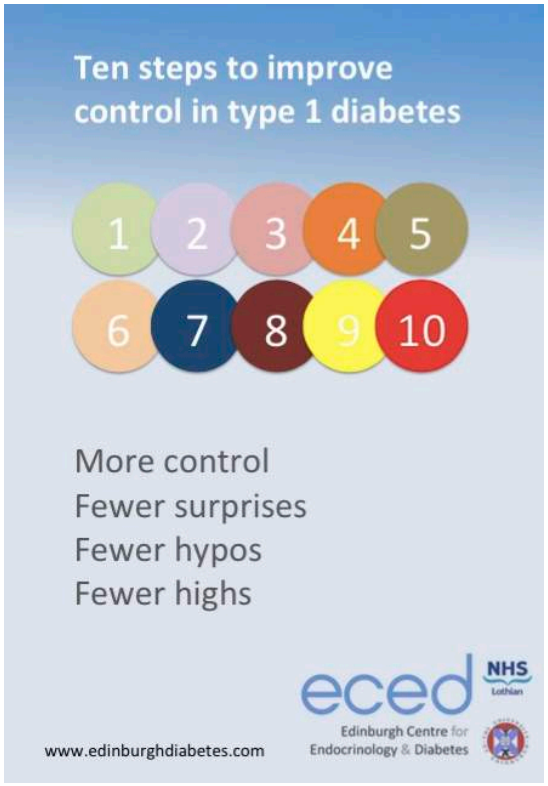
- Highly recommended
- Practical help for carb counting



Insulin to carb ratio

What is it and how to calculate

- First step is to make sure background (basal) insulin cover is appropriate
- Ideally <50% of total dose in most people
- Helps avoid weight gain and hypos
- More details on how to do this in our booklet



Insulin to carb ratio (ICR)

What is it and how to calculate

- Amount of insulin to take for a given amount of carbohydrate
  (e.g. 1 unit for 10 grams [1CP])

- Different between individuals

- Can be different at different times of day
  (more insulin required in the morning)

Insulin to carb ratio (ICR)

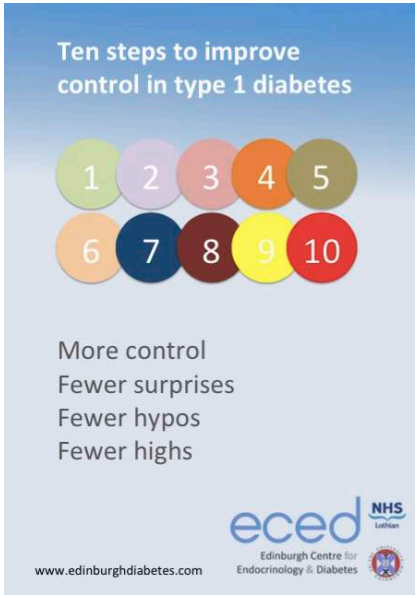
What is it and how to calculate

- Rule of 500
  - Take your total daily insulin dose (i.e. all quick-acting and background insulin) and divide into 500
  - So if you typically take 24 units of background insulin and around 26 units of quick-acting insulin the TDD is 50
  - 500 divided by 50 = ICR of 10
  - So 1 unit of insulin for every 10 grams carb

Insulin to carb ratio (ICR)

What is it and how to calculate

Average daily insulin dose (background and quick acting)	Approx I:C ratio
8 – 11	1:50
12 – 14	1:40
15 – 18	1:30
19 – 21	1:25
22 – 27	1:20
28 – 35	1:15
36 – 45	1:12
46 – 55	1:10
56 – 65	1:8
66 – 80	1:6
81 – 120	1:5
> 120	1:4



Insulin to carb ratio (ICR)

What is it and how to calculate

Kilograms	Stones	Approx I:C ratio
<27	< 4.2	1:30
27 – 36	4.3 – 5.7	1:25
37 – 45	5.8 – 7.1	1:20
38 – 54	7.2 – 8.6	1:18
55 – 64	8.7 – 10	1:15
65 – 77	10.1 – 12.1	1:12
78 – 90	12.2 – 14.2	1:10
91 – 104	14.3 – 16.4	1:8
105 – 122	16.5 – 19.3	1:6
>122	>19.3	1:5

- You can also make an estimate of ICR based on your weight
- The higher the weight – the more insulin is required to cover carbs

Insulin to carb ratio (ICR)

What is it and how to calculate

- Working out the ICR requires some trial and error
- Regular assessment of blood glucose (including 2 hours after meals) will help establish whether your ICR is correct
- Ideally glucose at 2 hours shouldn't be more than 2 mmol/L greater than before the meal

Insulin to carb ratio (ICR)

When to adjust

- ICR is not written in stone forever
- Consider adjusting when:
  - Requiring 2 or 3 daily correction doses that total more than 8% of your daily dose
  - You're having to give correction doses at the same time of day consistently
  - 2 hour post-meal glucose is consistently above/ below target

Insulin to carb ratio (ICR)

How to adjust

- If your ICR is 1:10 (1 unit for 10 grams) but you find glucose levels are consistently too high after meals, consider changing to 1:8 (1 unit for 8 grams) and reassess over the next week
- If your ICR is 1:10 but you are consistently having lows after meals, consider changing to 1:12 and reassess
- Small changes are advised

Correction factor

What is it and how to calculate it

- The amount of blood glucose lowering expected from 1 unit of insulin
- Typically added at mealtimes to get glucose down to target (normally 6 or 7 mmol/L)
- Rule of 100
  - Take your TDD and divide it into 100
  - So if taking 50 units per day = 100 / 50 = CF of 2
  - That is – 1 unit lowers 2 mmol/L glucose

Correction factor

When and how to adjust it

- First – is your background insulin appropriate?
- By CGM or monitoring BG
- If correction factor consistently failing to get next glucose to target may need adjusted
  - If '1 lowers 2' may need to change to '1 lowers 1.5'
- If correction factor consistently leading to low glucose (hypo) may need adjusted
  - If '1 lowers 2' may need to change to '1 lowers 2.5'

Selecting a dose

Examples

- Planning to have chicken and noodle stir-fry in 20 minutes
- Estimated 40g of carb
- Blood glucose is 12 mmol/L
- ICR is 1:10
- Correction factor is 1 unit for 2 mmol/L
- Target blood glucose is 6 mmol/L

- Dose:
- For food: 40 grams / 10 = 4 units
- For correction: (12 – 6) / 2 = 3 units
- **So total dose = 4 + 3 = 7 units**

Selecting a dose

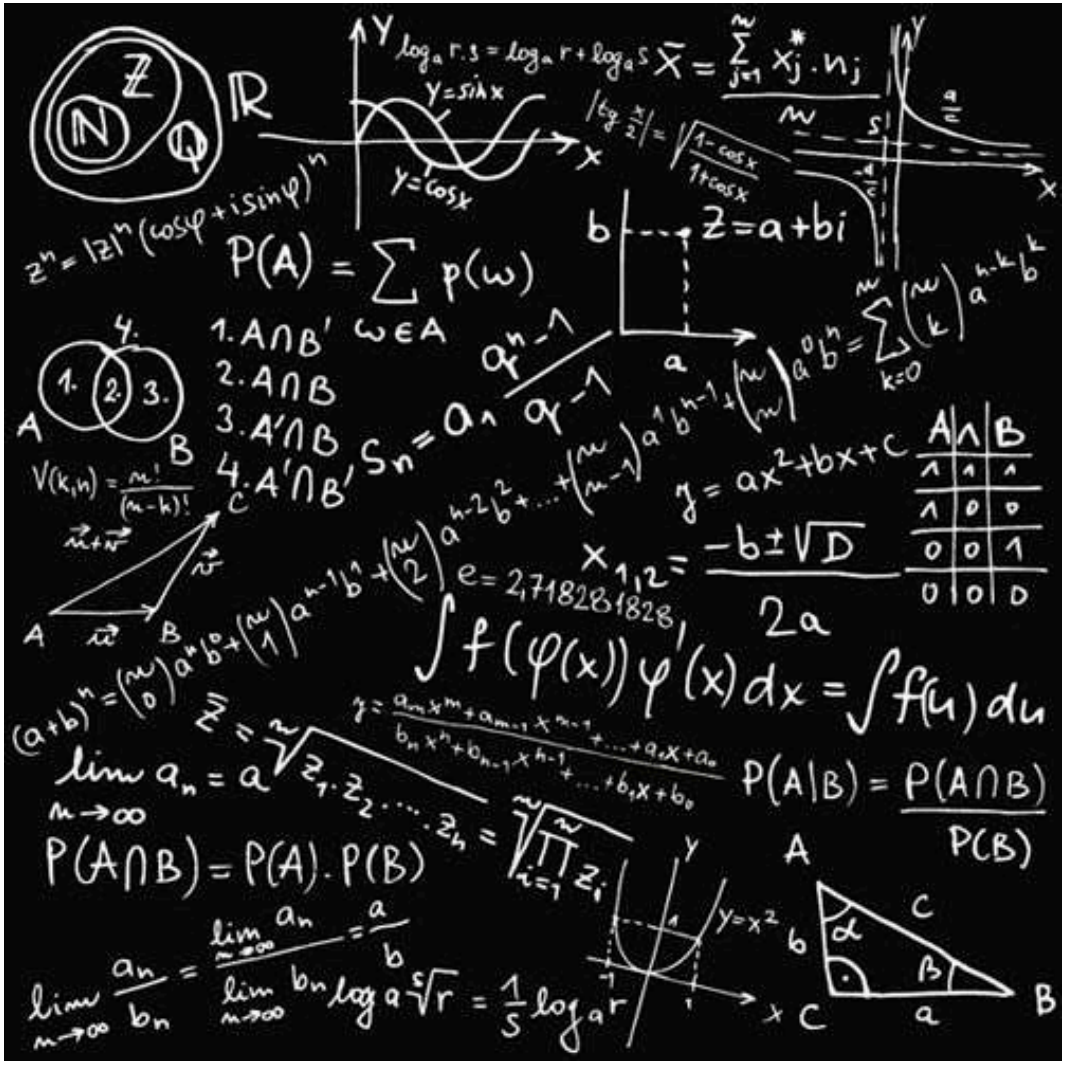
Examples

- Planning to have bread roll and macaroni cheese
- Estimated 25g + 55g of carb (80g)
- Blood glucose is 10 mmol/L
- ICR is 1:10
- Correction factor is 1 unit for 2 mmol/L
- Target blood glucose is 6 mmol/L

- <u>Dose:</u>
- For food: 80 grams / 10 = 8 units
- For correction: (10 – 6) / 2 = 2 units
- **So total dose = 8 + 2 = 10 units**

Help with carb counting

When the maths starts to get difficult!



Smart glucose meters

Helping with carb counting

- 'Smart-meters' and apps can help by using glucose level, correction factor and ICR
- You input the carb content of your meal and **a dose is suggested** based on the above
- Ask your diabetes team

Fat and protein

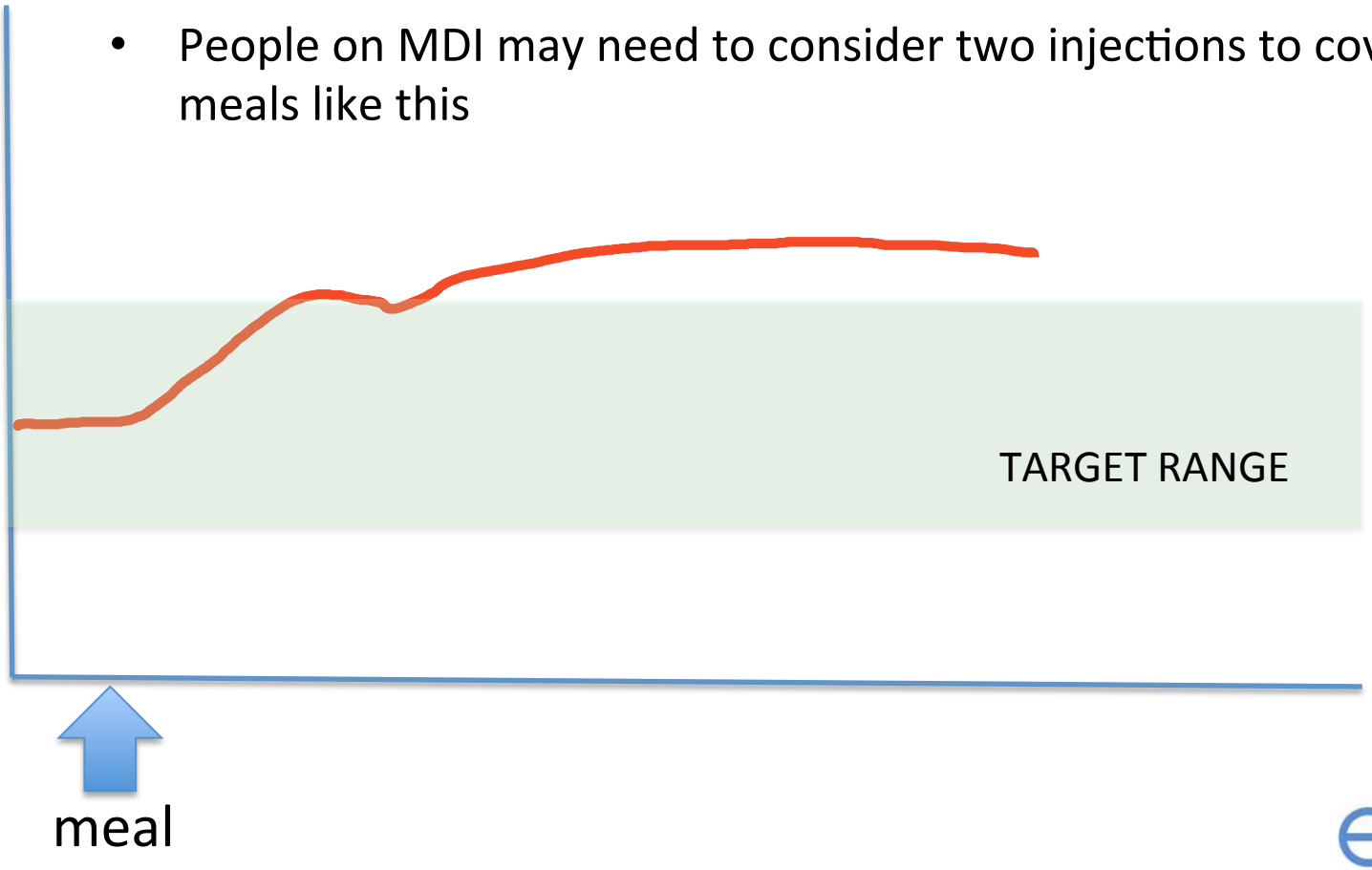
The effect and how to deal with it

- Fat and protein slow stomach emptying and prolong glucose absorption
- Glucose peaks can be pronounced and prolonged

Fat and protein

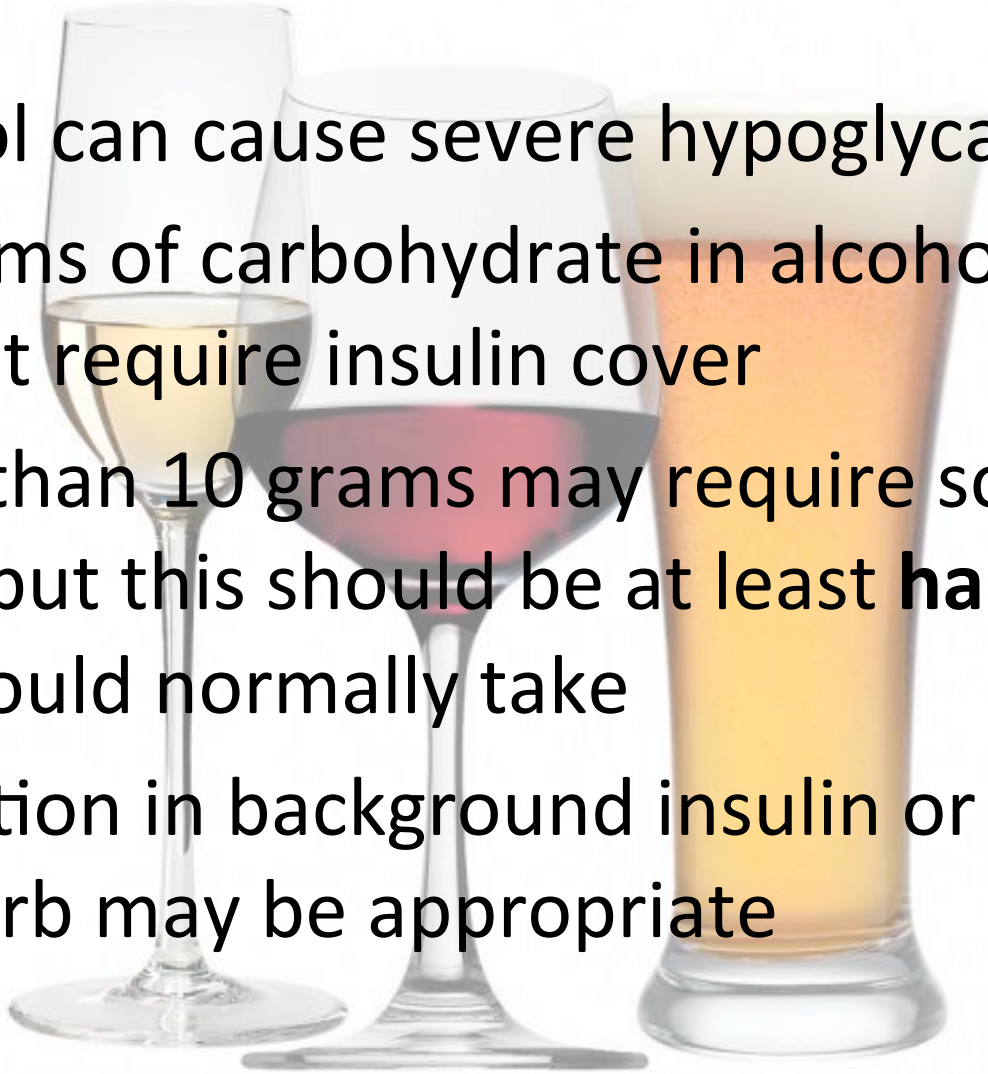
The effect and how to deal with it

- People on pumps can deliver dual wave bolus doses to cover a longer period
- People on MDI may need to consider two injections to cover meals like this



Alcohol

Can be tricky



- Alcohol can cause severe hypoglycaemia
- 10 grams of carbohydrate in alcohol (1CP) doesn't require insulin cover
- More than 10 grams may require some insulin cover but this should be at least **half** of what you would normally take
- Reduction in background insulin or extra pre-bed carb may be appropriate

Insulin pumps

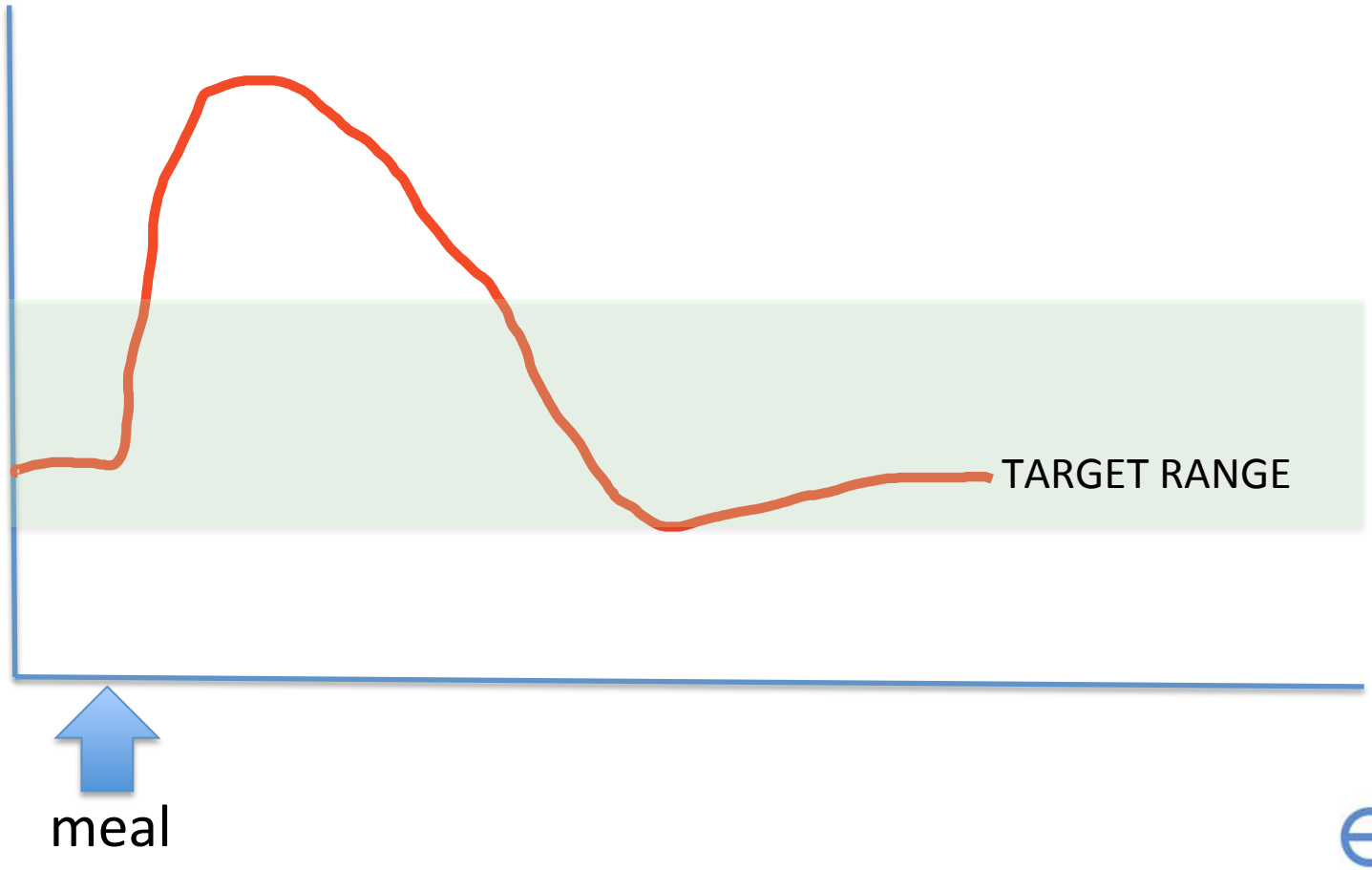
Extra features

- Active insulin time
- Bolus wizard
- Dual wave
- ‘Reverse’ correction
- Temporary basal rates
- Ability to look at patterns on pump download:

Continuous glucose monitoring

More information

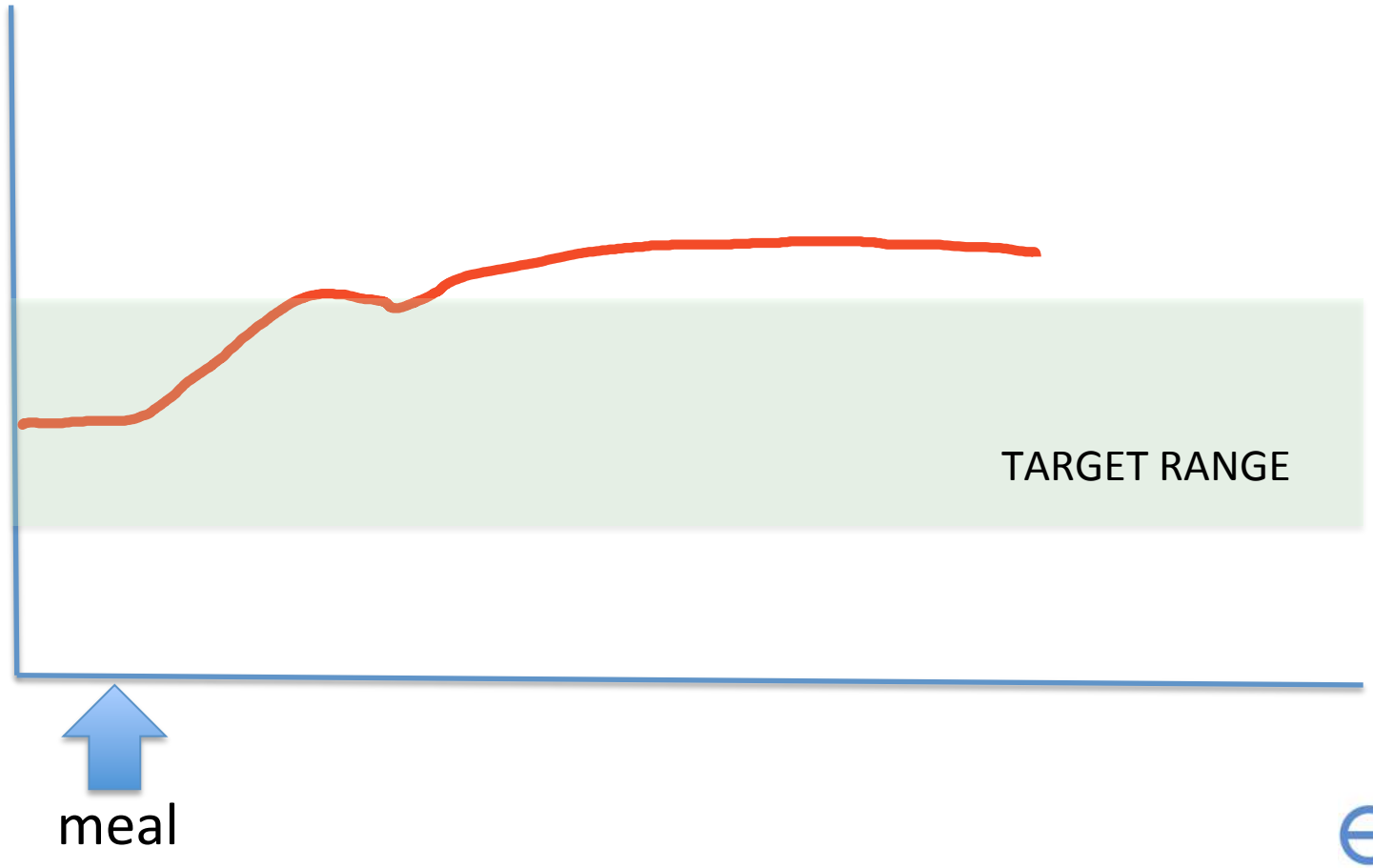
- Timing effect



Continuous glucose monitoring

More information

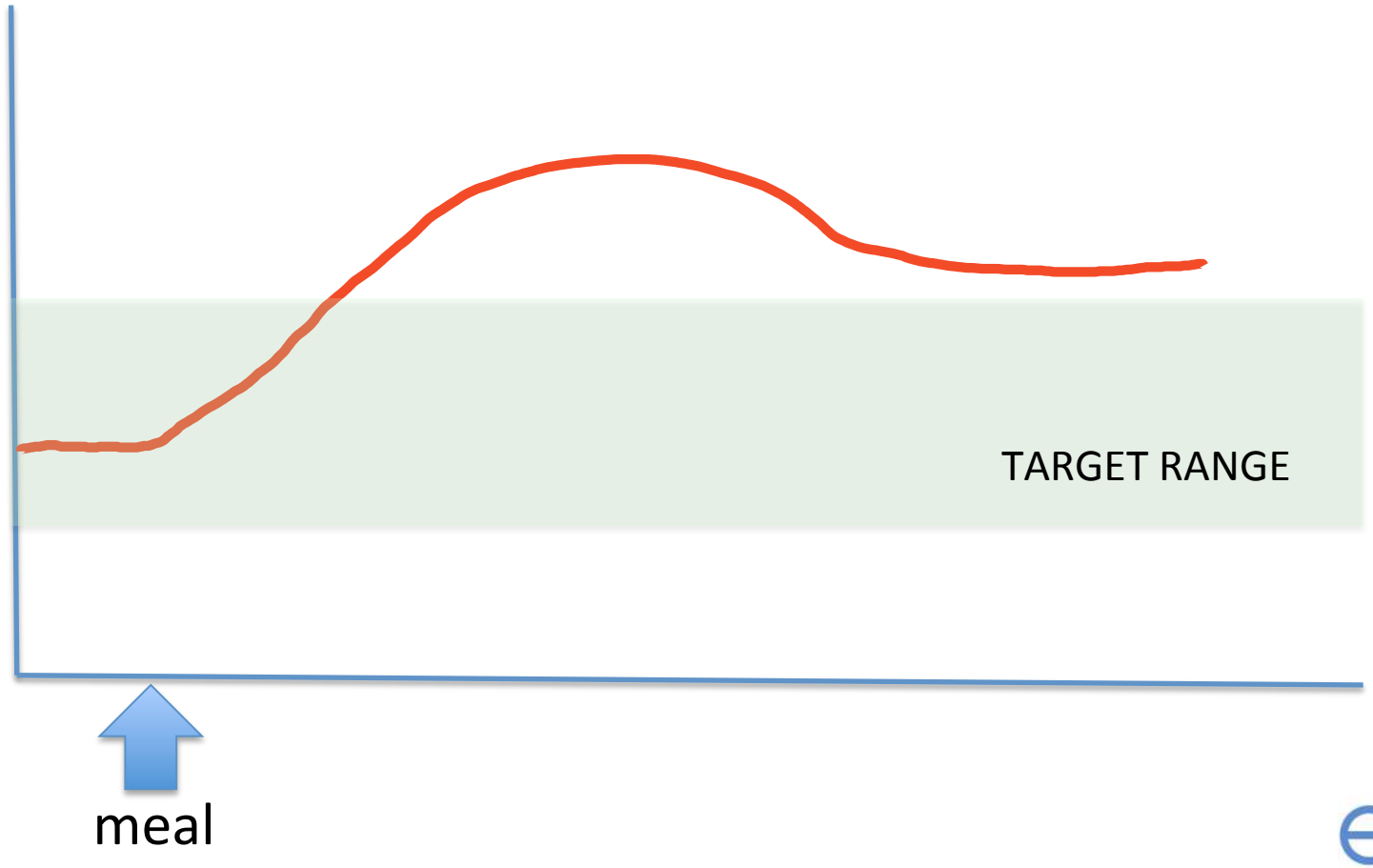
- Prolonged glucose rise



Continuous glucose monitoring

More information

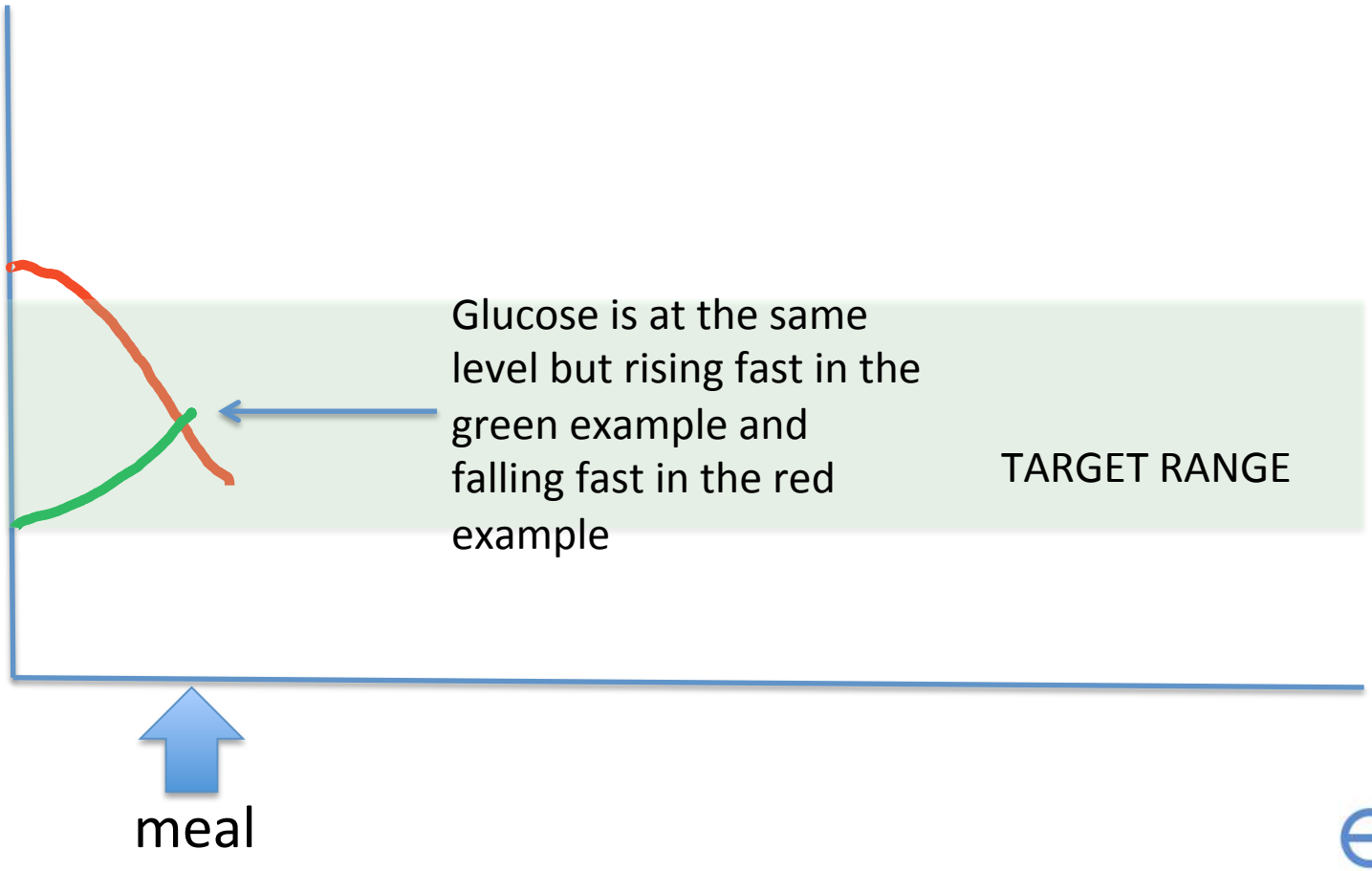
- Insufficient dose



Continuous glucose monitoring

More information

- Dose selection when glucose rising or falling



What next?

Other sources of information

- See the 'Improving control in type 1 diabetes' section on our website
- Links to the Accu-chek tool, BDEC online course and further information on DAFNE

BDEC
Bournemouth Diabetes and Endocrine Centre

DAFNE

Carbohydrate in food

- Accuracy of carb counting
- Glycaemic index

Fat and protein in food

- Effect on stomach emptying (slows)
- Effect on glucose disposal to muscle (reduces)

Counter-regulatory hormones

- Higher after hypos
- Higher with stress and illness
- Dawn phenomenon

Menstrual cycle

- Affects glucose in some women

Insulin factors

- Injections sites (giving set – pump)
- Variability of insulin (twice daily background better)
- Legs (slower) vs. Abdomen (faster)
- Timing of bolus
- Duration of bolus (pump)
- Needle length

Exercise / activity

- Different for anaerobic / aerobic exercise
- Duration of exercise

Alcohol

- Carbs increase glucose but later alcohol reduces liver glucose production

Stomach emptying

- Affected by high blood glucose
- Slowed by fat and protein in meals

Liver glucose production

- Reduced by insulin
- Increased by glucagon

Muscle glucose disposal

- Increased by insulin and exercise

Keep in touch

Our clinic is open 52 weeks every year

- Set up a Diasend account and share your glucose data with us
- Email us for advice
- See our website for further details