

Introduction to Carbohydrates and the FreeStyle Libre

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Disclosures:

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Learning objectives

- Identify sources of carbohydrate in the diet
- Explain the effect of carbohydrates on glucose levels
- Recognise how Glycaemic Index (GI) affects glucose levels
- Understand how carbohydrate counting can help you to manage glucose levels
- Understand how you can use the Freestyle Libre to assess carbohydrate counting skills

Sources of Carbohydrate

Starch	Sugar
Bread, chapatti, naan, rice, pasta, potato and potato products e.g. crisps, waffles, yam, noodles, grains e.g. couscous, quinoa, bulgar wheat, barley, cereals, crackers, flour, pastry, beans, pulses and lentils	Sucrose: biscuits, cakes, sweets, chocolate, puddings, jam, soft drinks Fructose: fruit- fresh, frozen, btinned, dried Lactose: milk, yoghurt, ice cream



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Effect of carbohydrate on glucose levels

After a meal or snack, the body breaks down carbohydrates into glucose (sugar)

This enters the blood stream and causes a rise in blood glucose levels

The body's cells need glucose for energy

Cells can only take up glucose when there is enough insulin present in the blood



In someone without diabetes this would happen automatically.

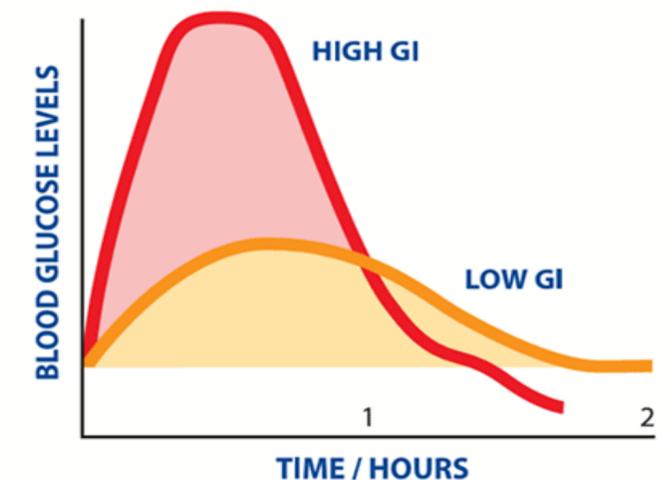
In Type 1 Diabetes carbohydrate counting is the tool used to do work out how much quick acting insulin to give.

Glycaemic Index (GI)

Different sources of carbohydrate are digested at different rates. They can be ranked according to the speed with which the glucose rises after a particular food.

Most foods are digested in 1-2.5 hours, low GI foods may take much longer.

High GI	Low GI
Rapid and more significant rise in glucose (quickly absorbed)	Gradual and less significant rise in glucose (slowly absorbed)



GI has limitations- foods eaten at the same time, fat/protein content and cooking methods

Glycaemic Index (GI)

It can be useful to use GI to determine if insulin is needed:

High GI	Low GI
Rapid rise	Minimal rise
Hypo treatment: fruit juice, cola, lucozade, glucose/dextrose tablets, jellied and boiled sweets	Lentils, beans and pulses, nuts, barley, grapefruit
Quick acting insulin is too slow to match these foods/drinks. Result = high glucose levels	Quick acting insulin is often too quick for these foods. Result = risk of hypos

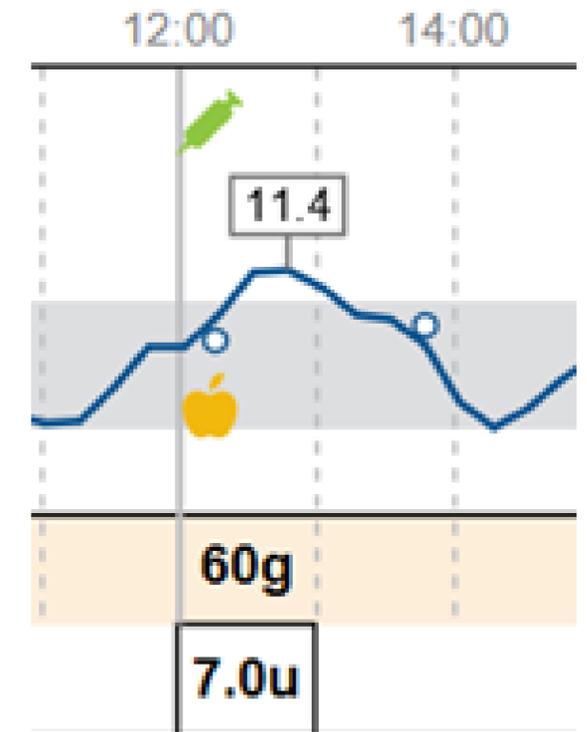
All other sources of carbohydrate can be matched with your quick acting insulin regardless of the GI.

For more information on GI speak with your diabetes team.

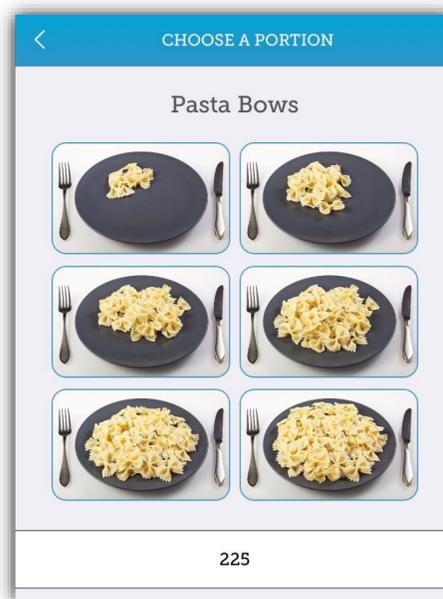
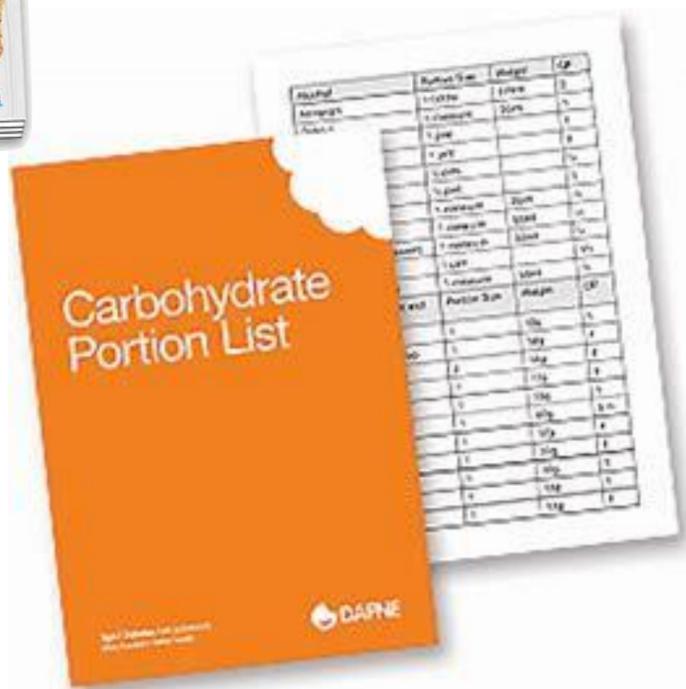
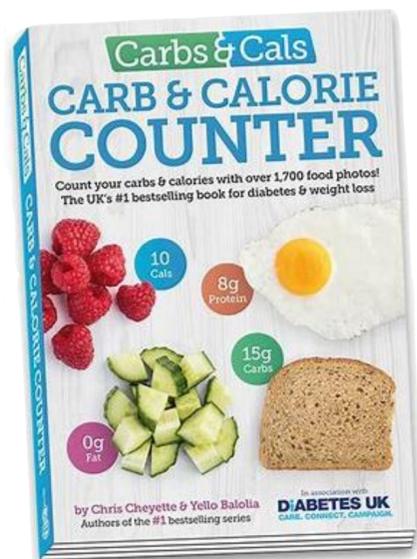
Carbohydrate Counting

Working out the correct dose of quick acting insulin according to how much carbohydrate is eaten and the current glucose value to maintain target glucose levels.

- Allows freedom to eat various types and amounts of carbohydrate
- Allows flexibility to vary the timing of meals and snacks
- Requires time to learn about the glucose response to meals



Resources to help with Carbohydrate Counting



INGREDIENTS:
100% Wholegrain Rolled Oats
 Allergy Advice: For Allergens, see ingredient in bold

NUTRITIONAL INFORMATION

Typical Values	Per 100g	*Per 40g Serving	Reference Intake**
Energy	1566 kJ 371 kcal	626 kJ 148 kcal	8,400 kJ 2,000 kcal
Fat	5.8g	2.3g	70g
(of which saturates)	1.0g	0.4g	0g
Carbohydrate	64g	26g	60g
(of which sugars)	0.9g	0.4g	0g
Fibre	8.3g	3.3g	
Protein	11g	4.5g	50g
Salt	< 0.01g	< 0.01g	6g
Iron	3.6 mg (26% NRV***)	1.4 mg (10% NRV)	
Thiamin	0.36 mg (33% NRV)	0.14 mg (13% NRV)	

*Prepared with water
 **Reference Intake of an average adult (8400kJ/2000kcal)
 ***Nutrient Reference Value



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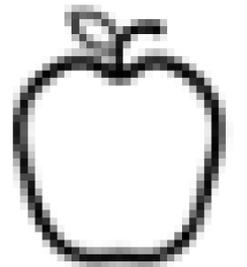


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Carbohydrate Counting

Common Terms

I:C ratio - Insulin to Carbohydrate Ratio- Individual glucose response to **carbohydrate** → How much quick acting insulin is needed to cover the rise from carbohydrate



Correction Factor (ISF)- Insulin Sensitivity Factor - Individual glucose response to **quick acting (QA) insulin** → How much 1 unit of quick acting insulin lowers glucose e.g. ISF 1:3 = 1 unit of QA reduces glucose by 3 mmol/l



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I:C ratios

Different methods are used by individuals

- Some people change the units of insulin for every 10g of carbohydrate or 1 carbohydrate portion (CP)
- Some people change the grams of carbohydrate for 1 unit of insulin

Units for every 10g	Units for every 1CP	Grams for every 1 unit
0.5:10	0.5:1	1:20
0.7:10	0.7:1	1:15
1:10	1:1	1:10
1.5:10	1.5:1	1:7
2:10	2:1	1:5
2.5:10	2.5:1	1:4
3:10	3:1	1:3



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Typical I:C ratios

- Some people use Total Daily Dose of insulin (TDD) to work out I:C ratios
e.g 46-55 units → 1:10g
- Some people use body weight to work out I:C ratios
e.g. 78-90kg → 1:10g
- I:C ratios can be different at different times of the day
- Speak with your diabetes team if you are unsure where to start



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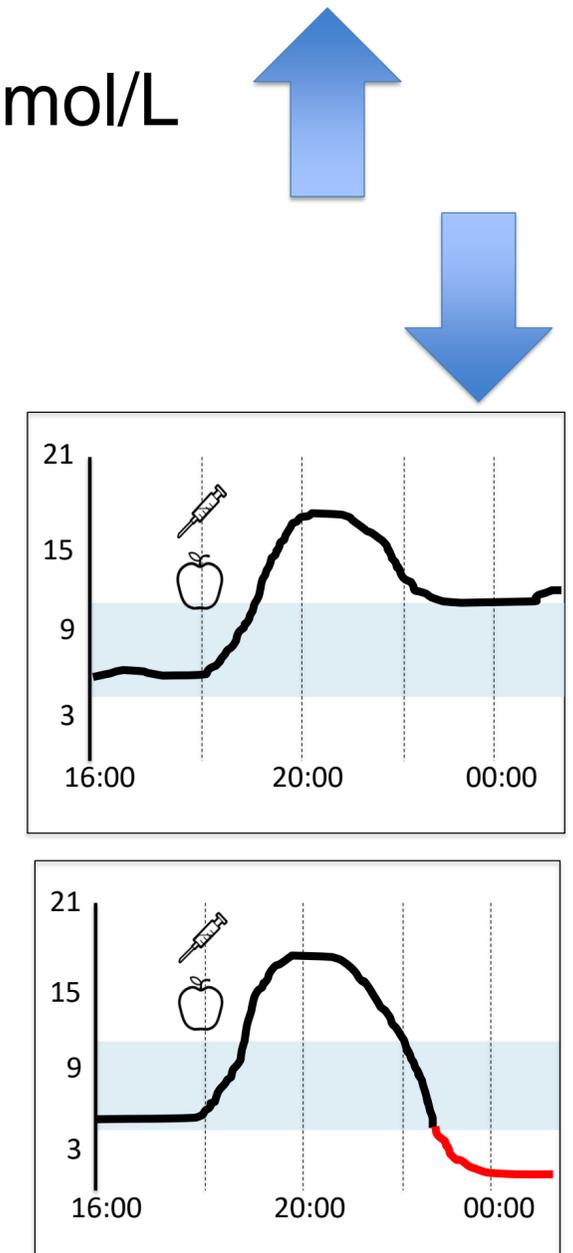


Carbohydrate Counting

- Typically 10g or 1 carbohydrate portion (CP) raise glucose levels by 2-3mmol/L
- Typically 1 unit of quick acting insulin lowers glucose levels by 2-3mmol/L

Individual responses will vary

- Underestimating the carbohydrate content or forgetting to inject/bolus for snacks will lead to raised glucose levels
- Overestimating the carbohydrate content may lead to low glucose levels (hypoglycaemia)
- **It is therefore crucial to have accurate carbohydrate counting skills**



Selecting a dose

Spaghetti bolognaise with garlic bread

Estimated 60g carbs for the pasta and 20g for the garlic bread = 80g carbs

Glucose = 12 mmol/l

I:C ratio = 1:10 g or 1:1

ISF = 1:2 mmol/l

Target glucose 6 mmol/l

For food: $80\text{g} \div 10 = 8$ units

For correction: $12 - 6 = 6 \div 2 = 3$ units

Total dose: $8 + 3 = 11$ units



How can the Freestyle Libre help?

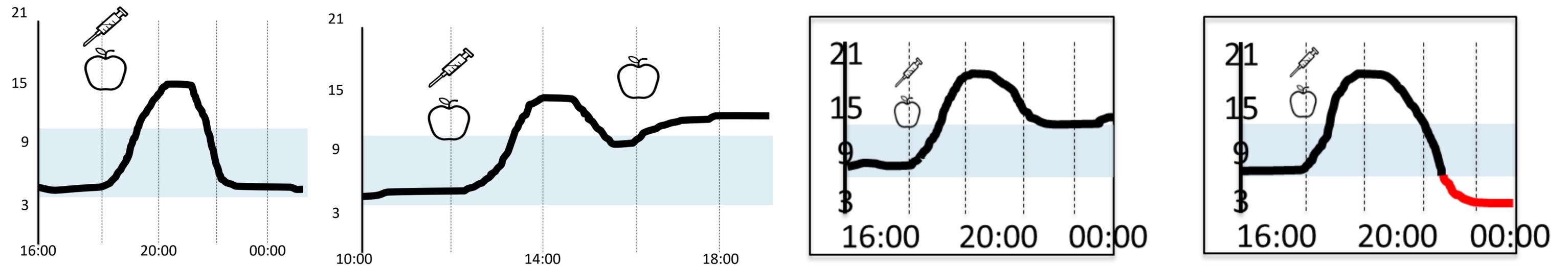
You can set up the Libre reader “bolus calculator” to support with the maths

- Requires a blood test pre meal
- Enter the grams of carbs eaten or CPs
- Suggests a dose based on I:C ratio, ISF and target set
- Other bolus calculator apps are available



How can the Freestyle Libre help?

Libre traces give you more insight into how the carbohydrate you eat affects glucose levels



You can use this information to:

- Make changes to the amounts or type of carbohydrate eaten
- Determine the correct dose or ratio of quick acting insulin
- Take the insulin at the appropriate time

If you want to learn more, see Dr Jackie Elliott's module on getting bolus insulin right

Conclusion

- Carbohydrates have a direct effect on glucose levels
- Glycaemic Index determines how quickly and significantly carbohydrate affects glucose levels
- Crucial to understand carbohydrate counting to achieve optimal glucose control
- The Libre provides more information than traditional blood glucose testing
- Not just the amount of carbohydrate that matters....
- See Module 2 online: Fat and Protein and the Freestyle Libre