

Insulin in type 1 diabetes

- Basal bolus

Basal bolus insulin is used to replace the insulin that is no longer produced in type 1 diabetes. The 'basal bolus insulin' approach most closely matches how the body would make insulin in a person without type 1 diabetes.

The aim of insulin is to:

- > bring your high blood glucose levels back into target range
- > avoid low blood glucose levels
- > reduce your risk to diabetes related complications.

What is basal bolus insulin?

Basal bolus insulin is a combination of long acting insulin and rapid acting insulin injections.

The main advantage of using basal bolus insulin is that it allows you to match how your own body would release insulin if it was able to. Basal bolus insulin is also more flexible than using 'fixed' insulin doses as it allows you to choose what you want to eat, when you want to eat it.

What is basal insulin?

Basal insulin is also known as background insulin.

There is always some glucose in your blood even when you are asleep or when you have not eaten for some time (eg between meals). This is because your body releases a constant supply of glucose into the blood to supply the different cells with energy.

Basal insulin is needed to allow those cells to take in and use glucose. It assists your body to get the energy it needs, while keeping your blood glucose levels within target levels when you are asleep or during the day (eg between meals).

Long acting insulin or intermediate acting insulin is used because basal insulin needs to act over a long period of time.

Basal insulin makes up about 50% of the insulin you need in 24 hours and is commonly given once a day at night time (eg 9:00pm). It can also be given at other times or split into two injections at morning and night, depending on the insulin used.

What is bolus insulin?

Bolus insulin is also known as meal related insulin. It is taken just before you eat and aims to keep the blood glucose levels, which rise after eating, in target.

Rapid acting insulin is most commonly used because bolus insulin needs to act quickly.

Bolus insulin starts working within 15 minutes and is taken immediately before meals. Some people may be advised to take their insulin during a meal (eg if hypoglycaemia needs to be prevented) and others immediately after a meal.



Bolus insulin does not last long, so it allows for greater flexibility in the timing of meals as a meal dose is unlikely to 'overlap' with another meal dose.

Bolus insulin makes up about 50% of the insulin you need in 24hours and is split between your main meals (eg breakfast, lunch and dinner). Adjusting your dose allows for greater flexibility in the amount of carbohydrates (CHO) you eat.

Total daily dose

Your total daily dose (TDD) is the number of units of insulin you use in 24hours added together. The TDD is commonly used to calculate how much rapid acting insulin is required for a particular meal or to calculate how much extra rapid acting insulin is needed to return a high blood glucose level back into target.

Example Total Daily Dose (TDD)		My Total Daily Dose (TTD)	
Bolus dose: Breakfast	8 units	Bolus dose: Breakfast	units
Bolus dose: Lunch	8 units	Bolus dose: Lunch	units
Bolus dose: Dinner	8 units	Bolus dose: Dinner	units
Basal dose: Bedtime	26 units	Basal dose: Bedtime	units
Total Daily Dose:	50 units	Total Daily Dose:	units

Your diabetes specialist, doctor or credentialled diabetes educator can assist you to learn more about adjusting your bolus insulin doses using your TDD.

Calculating rapid acting insulin doses for meals

All carbohydrate (CHO) foods are digested into glucose. The amount and type of CHO you eat will affect how high and how quickly your blood glucose levels rise after a meal.

Complex CHO are recommended at each meal and simple CHO are recommended as 'occasional foods'. It is important to know what a CHO food is and how much you are eating so you can match your rapid acting insulin dose correctly.

CHO are generally counted in grams or 15gm exchanges (or serves). A rapid acting insulin dose can be calculated for the number of grams or exchanges you eat (eg for this many exchanges, this much insulin is needed).

To calculate the rapid acting insulin dose required for a main meal, the 500 Rule is commonly used with your TDD. This is known as your Insulin:Carbohydrate (CHO) Ratio.

Insulin:CHO Ratio using the 500 Rule

Example Total Daily Dose: 50 units	My Total Daily Dose: ____ units
<p>Step 1: Divide 500 by your TDD</p> $500 \div 50 = 10$ <p>If counting in grams, the answer suggests that 1 unit of rapid acting insulin is required for every 10grams of CHO.</p>	<p>Step 1: Divide 500 by your TDD</p> $500 \div ___ = ___$ <p>If counting in grams, the answer suggests that 1 unit of rapid acting insulin is required for every ____grams of CHO.</p>
<p>If counting in 15gm exchanges</p> <p>Step 2: Divide 15 by the answer from Step 1</p> $15 \div 10 = 1.5$ <p>The answer suggests that 1.5units of rapid acting insulin is required for every 15gram exchange of CHO.</p>	<p>If counting in 15gm exchanges</p> <p>Step 2: Divide 15 by the answer from Step 1</p> $15 \div ___ = ___$ <p>The answer suggests that ____units of rapid acting insulin is required for every 15gram exchange of CHO.</p>

A credentialed diabetes educator and dietitian will assist you to better understand what will work for you.

Are there any precautions?

Yes. This calculation is based on your current insulin doses and may require fine tuning. It should be reviewed if your insulin requirements change (eg change in activity, weight, illness, medication and if you become pregnant).

Calculating rapid acting insulin doses for correcting out of target blood glucose

Blood glucose levels can sometimes go out of your target range. If your blood glucose is low, you are at risk of hypoglycaemia. If your blood glucose is high and you have ketones, you can become unwell and quickly develop diabetic ketoacidosis.

Correctional doses are also known as supplemental insulin and should be used to manage hyperglycaemia and ketosis.

Correctional insulin doses should be given straight away and should not be delayed until the next usual insulin dose is due. Only rapid acting insulin is used as correctional insulin must work quickly.

Correctional doses are taken in addition to your basal insulin and bolus insulin at meal times. To avoid insulin doses 'overlapping' and the risk of your blood glucose level dropping too low, a correctional dose must not be given within 2 hours to the last dose of rapid acting insulin.

Correctional insulin can be given every 2-4 hours but you should seek medical assistance if your blood glucose remains high despite 2 extra correctional insulin doses.

To calculate the rapid acting insulin dose needed to correct out of target blood glucose, the 100 Rule is commonly used with your TDD. This is known as the Insulin Sensitivity Factor (ISF) and identifies how much your blood glucose level will lower if an extra 1unit of rapid acting insulin is given.

Insulin Sensitivity Factor (ISF) using the 100 Rule

Example Total Daily Dose: 40 units	My Total Daily Dose: ____ units
Step 1: Divide 100 by your TDD $100 \div 40 = 2.5$ The ISF is 2.5mmol/L. The answer suggests that 1unit of rapid acting insulin will lower the blood glucose level by 2.5mmol/L.	Step 1: Divide 100 by your TDD $100 \div ___ = _____$ My ISF is ____mmmol/L. The answer suggests that 1unit of rapid acting insulin will lower my blood glucose level by ____mmol/L.
5% of TDD: 2units	5% of my TDD: ____units
10% of TDD: 4units	10% of my TDD: ____units

Correctional doses are guided by your ISF and a percentage of your TDD. Correctional doses greater than 10% of your TDD are not recommended. Talk to your diabetes specialist, doctor or credentialed diabetes educator about what correctional dose suits you.

Are there any precautions?

Yes. Your ISF and correctional dose calculation is based on your current insulin doses and may require fine-tuning. It should be reviewed if your insulin requirements change (eg change in activity, weight, illness, medication and if you become pregnant).

Seek urgent medical assistance (eg ring an ambulance or ask someone to take you to the hospital emergency department) if;

- > your blood glucose remains above 15mmol/L despite 2 extra correctional insulin doses
- > you become drowsy or confused

- > have fast or usual breathing
- > have abdominal pain
- > unsure of what to do.
- > too unwell to stay home.

A diabetes specialist, doctor, credentialled diabetes educator and dietitian will assist you to better understand what will work for you and assist you to learn more.

Where can I go for more information?

Diabetes Australia

www.diabetesaustralia.com.au

National Diabetes Services Scheme

www.ndss.com.au

My D (for under 25s)

www.ndss.com.au/MyD/

Australian Diabetes Educators Association

www.adea.com.au

Department of Health

www.health.gov.au

For more information

CHSA Diabetes Service
Country Health SA LHN

PO Box 287, Rundle Mall

ADELAIDE SA 5000

Telephone: (08) 8226 7168

www.chsa-diabetes.org.au

