

## Types of insulin

- **Rapid acting** (given at start of meal)
  - Novorapid (Aspart)
  - Humalog (Lispro)
  - Apidra (Glulisine)
- **Short acting** (given 15-30 mins before a meal)
  - Actrapid
  - Humulin S
- **Intermediate acting** (usually given once/twice daily or as part of mix)
  - Humulin I
  - Insulatard
  - Insuman basal
- **Long acting** (usually given once daily)
  - Lantus (Glargine)
  - Levemir (Detemir)
  - Tresiba (degludec)

### Normal values (mmol/L)

Non-diabetic (random) = 3.5-7.8  
 Type 1 diabetic = 4-9  
 Type 2 diabetic = 4-8.5  
 Hyperglycaemia = >11  
 Hypoglycaemia = <3.5

### Mixtures (for twice daily pre-mixed regimens)

#### Intermediate + short (given 30mins before breakfast and dinner)

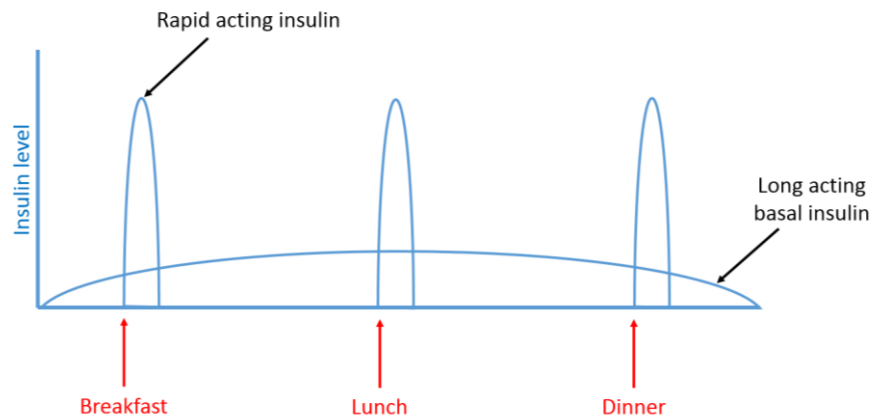
- Humulin M3 (30% short-acting)
- Insuman comb 15 or 25 or 50 (15/25/50% short-acting)

#### Intermediate + rapid (given at start of breakfast and dinner)

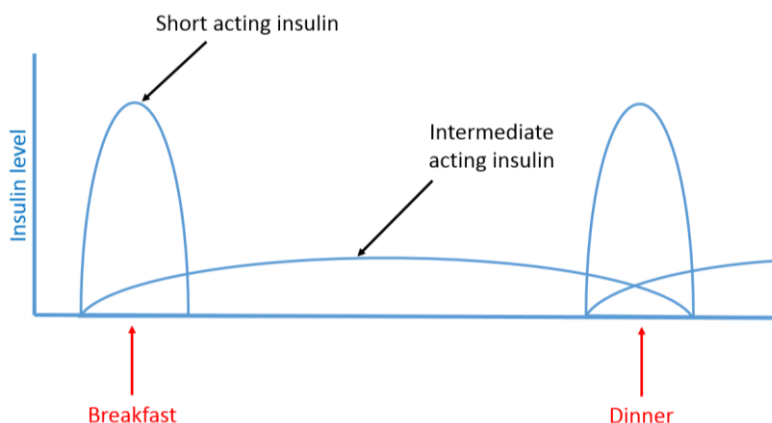
- Novomix 30 (30% rapid-acting)
- Humalog Mix 25 or 50 (25/50% rapid-acting)

## Regimens

- **Basal bolus regimen** (basal long acting insulin given at night with rapid acting insulin given before every meal):



- **Twice daily pre-mixed regimen** (mixed intermediate and short/rapid insulin given BD, before breakfast and before dinner):



- Other insulin regimes used in type 2 diabetes (in addition to above)
  - **Once daily morning/evening regimen** (intermediate acting insulin may be given in the morning to supplement daytime oral hypoglycaemic medication or in the evening to reduce overnight/morning glucose levels; long acting insulin may also be used but is less common)
  - **Twice daily intermediate regimen** (less common)

## Adjusting insulin regimes (in response to glucose levels)

- Always review the capillary glucose monitoring chart and pattern in relation to meals (level is usually tested before meals)
- Use common sense – if a patient's eating less, the insulin dose will need to be reduced and certain conditions may require it to be increased (see box)
- Adjusting a **basal bolus regimen**:
  - High/low before breakfast (or in night) → increase/decrease evening long acting insulin
  - High/low before lunch or dinner or bed → increase/decrease rapid acting insulin given with meal before
- Adjusting a **twice daily pre-mixed/intermediate regimen**:
  - High/low before bed and before breakfast → increase/decrease evening insulin
  - High/low before lunch and before evening meal → increase/decrease morning insulin
- Adjusting a **once daily morning regimen**:
  - High/low before lunch and evening meal → increase/decrease insulin
- Adjusting a **once daily evening regimen**:
  - High/low before breakfast → increase/decrease insulin
- Doses are usually adjusted by approximately 10% depending on how abnormal the glucose levels are; capillary glucose levels must then be closely monitored and dose adjusted as required (it's partly trial and error)
- Remember, hypoglycaemia is more dangerous than hyperglycaemia
- If you can't get on top of it, ask the diabetes team for help (insulin type may need changing)

### Changes in insulin requirements

#### Increased requirements

- DKA/HHS
- Sepsis
- Steroids
- Missed doses
- Pancreatitis
- Dehydration

#### Decreased requirements

- Reduced calorific intake
- Reduced renal function (may reduce drug excretion)
- Alcohol

## Insulin pumps

- Insulin pumps continuously infuse a basal rate of rapid/short acting insulin subcutaneously
  - The rate can be changed depending on requirements (e.g. during exercise, diet or capillary glucose level)
  - A button is pressed to give an insulin bolus at the start of a meal
- If patients are nil by mouth, they should continue their basal rate but not give any boluses
  - 5% dextrose infusion can be given and their basal rate adjusted accordingly – they do not need a variable rate insulin infusion

## Variable rate insulin infusions

- Used for diabetic patients who are nil by mouth e.g. peri-operatively
- The capillary glucose is checked 1-2 hourly and the rate of insulin infusion is modified accordingly (as per a pre-made protocol)
- Continuous IV fluids containing glucose must also be given to maintain basal glucose levels and hydration
- **Starting** a variable rate insulin infusion
  - Most hospitals have a variable rate insulin infusion chart which just needs a signature
  - Continuous IV fluids also need prescribing as below
  - If the patient is taking long acting insulin, this should be continued throughout (but short/rapid acting insulin must be suspended)
- **During** a variable rate insulin infusion
  - Continuous IV fluids
    - Surgical patients: 5% glucose/0.45% saline/ 0.15% KCl at 80ml/h
    - Medical patients: 5% glucose (1L with 20mmol KCl) at 100ml/h (unless capillary glucose is >15mmol/L, then give 0.9 saline until it returns to <15mmol/L)
  - Check plasma Na<sup>+</sup> and K<sup>+</sup> daily
  - Re-sign the variable rate insulin infusion chart daily
  - The protocol's infusion rates can be modified if the patient is particularly insulin resistant/sensitive
- **Stopping** a variable rate insulin infusion
  - Confirm patient is eating and drinking
  - Ensure the patient has their long acting insulin on-board (given at least 1 hour before stopping)
  - Give their usual mixed/rapid acting insulin at usual mealtime and wait 30 minutes before stopping the variable rate insulin infusion
  - Monitor capillary glucose QDS for at least 24 hours

### Example variable rate insulin infusion protocol

Capillary glucose (mmol/L)	Infusion rate (UNITS/h)
<4	Stop insulin
4-7	1
7-10	2
10-15	3
>15	6

Insulin infusion is made up of **50 UNITS Actrapid insulin in 50ml 0.9% saline**

## Insulin prescribing rules

- Prescribe on insulin prescription chart if available (and write 'insulin as per insulin prescription chart' at all relevant times on main inpatient drug chart)
- You must write "UNITS" (do not abbreviate to U)
- Specify the **brand name**
- Indicate the **device** the patient uses (e.g. disposable pen, vial, pen cartridge)
- Write "**pre-breakfast/lunch/dinner**" rather than times if the insulin must be taken pre-meal
- Ensure you corroborate their prescription if unsure of a dose, never estimate

Example insulin prescription chart (basal bolus regimen):

Time	Insulin name	Device	Dose	Doctor name (bleep)	Signature	Date
Pre-breakfast	Novorapid	Pen cartridge	5 UNITS	C Mansbridge (2272)	<i>Cm</i>	07/07/2015
Pre-lunch	Novorapid	Pen cartridge	5 UNITS	C Mansbridge (2272)	<i>Cm</i>	07/07/2015
Pre-dinner	Novorapid	Pen cartridge	7 UNITS	C Mansbridge (2272)	<i>Cm</i>	07/07/2015
Bedtime	Lantus	Vial	16 UNITS	C Mansbridge (2272)	<i>Cm</i>	07/07/2015

Example insulin prescription chart (twice daily pre-mixed regimen regimen):

Time	Insulin name	Device	Dose	Doctor name (bleep)	Signature	Date
Pre-breakfast	Humulin M3	Pen cartridge	24 UNITS	C Mansbridge (2272)	<i>Cm</i>	07/07/2015
Pre-dinner	Humulin M3	Pen cartridge	22 UNITS	C Mansbridge (2272)	<i>Cm</i>	07/07/2015

## Acute management of hypo/hyperglycaemia

- See notes on [diabetic emergencies](#)